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A Large Manufacturer of Nickel Silver, Phosphor Bronze, and Nickel Anodes

A Description of the Products, Plant and Manufacturing Methods of The Seymour Manufacturing Co., Seymour, Conn. A Sketch of the History and Uses of Nickel Silver and Phosphor Bronze.

THE Seymour Mfg. Company began operations in 1878, near its present location in Seymour, Conn., in a plant which, with its 30,000 or so sq. ft. was prententious for its time, but which, judged by today's standards of modern, high speed machinery and long-range distribution, was small indeed.

A main building with three pairs of rolls, two muffles and three wire blocks, and a casting shop utilizing 25 pit fires, served immediate New England territory with perhaps a thousand pounds a day of copper, brass and nickel silver sheet, wire and rod. In addition, a flourishing rod mill supplied a limited number of quantity customers with rolled copper rods.

The contrast between this modest outlay and the equipment of the Seymour Mfg. Company of today, including a force of approximately 500 employees and well over 350,000 square feet of floor space, is of interest not only as an index to the progress of a single non-ferrous industry, but also as a vivid reminder of how far our country as a whole has come in less than a single generation!

The present output of The Seymour Manufacturing Co., Seymour, Conn., is composed of Nickel Silver, Phosphor Bronze, Commercial Bronze, Brass,

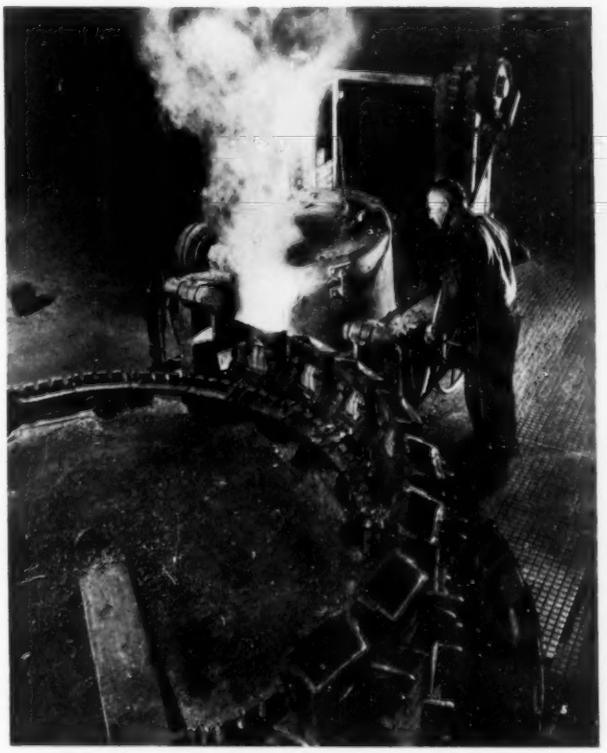

Fig. 1. A View of the Casting Operation

and Anodes for plating nickel, copper, brass, bronze and zinc.

Nickel Silver

Nickel silver is an alloy of copper, nickel and zinc. The color, hardness and other physical characteristics vary according to the proportions of the three metals —particularly of the nickel content, which may range from 5% to 30%. It is decidedly corrosion resistant and a wide range of physical characteristics is pos-

Fig. 2. Running Down Rolls

sible, from very soft to a resilient spring temper. This flexibility fits it for almost universal application in machine and product design.

An Ancient Alloy

As early as 235 B. C., crude coins were cast from the forerunner of nickel silver. In Canton, the Chinese, the first workers of this alloy, carried it in odd-shaped rings slung on shoulder poles to smelting furnaces for refining with zinc. Long caravans out of southern China struggled over the perilous mountain routes across India to Bactria, bringing a rare, white metal which they called "pack tong." Candle sticks and ornamental boxes made from this were bartered to the East India Company, and eventually sold in England and Germany as rare and beautiful objects of Chinese craftmanship. The Chinese also called this metal "pai t'ung" (white copper), the English, tuteneg, toothanegg, totenars—but it was the ancient "pack tong," a combination of copper, nickel and zinc, an equivalent of the nickel silver of today.

The scene now changes to quaint, old Schneeburg, Saxony. Excited mule drivers hurry a new, rich ore to the villages furnaces. There, in spite of every effort, neither silver nor copper can be extracted. "Those cursed Elfin," the smelters fume, "have put upon this rich ore the spell of Old Nick. It makes no kupfer, only kupfer-nikkel. Bah!" and the name sticks even after the jinx is found to be another metal.

But, in 1751, after five years of arduous toil, Axel Cronstedt broke the "spell." With only the most meagre smelting equipment, this persistent young Swede finally produced a new metal which he called "kupparnickel," or "nickel" for short.

Fifty-two years later, in Berlin, Dr. J. B. Richter and associates obtained a pure nickel. To Dr. Richter's lasting credit, let us record that his specific gravities of 8.278 for the ingot and 8.666 for the forged state were practically the same as are accepted today! After proving the correctness of his findings to his many skeptical contemporaries, he published them in a book, which, in accuracy of analysis, was a contribution of definite worth.

In 1830 a Herr Guitike introduced a new compound metal to the Sheffield platers of England. It was too brittle for general use at the time, but a few years later this "German Silver," as it was called, was adopted in some factories as a base meal for Sheffield Plate in place of copper. Some ten years after that, however, as electroplating began to assume commercial importance, the production of "German Silver" received an impetus which has not slackened to the present day. The name "German Silver" was used for this alloy in this country until the World War, when, at the behest of the government, it was changed to "Liberty Silver." After the war, the adoption of the term "Nickel Silver" became general; it was more descriptive of this alloy and England had been using it for over a hundred years.

Present Uses for Nickel Silver

Nickel silver finds an extensive use in the silverware field as a plating base for the various pieces composing a silver service, such as flat ware, hollow ware, etc., and for untold hundreds of silver novelties, such as ash trays, cigarette lighters, knife handles, and a wide bracket of jewelry items. It is recommended as a base for silver plating because of the fine, even grain and the remarkable control of ductility which are possible, for which reasons it is ideal for spinning, drawing and stamping. It flows smoothly under die or spinning tool and comes away with a surface that is a perfect foundation for silver, nickel, chromium, or any other plating.

Drawing articles from nickel silver has proved more economical than from many other nonferrous alloys because, due to its remarkable ductility, five and six draws are sometimes possible without the usual anneals!

Another reason for the general use of nickel silver in the silverware industry is its white color. When eventually exposed by wear, it is so nearly like real silver that the worn area is scarcely perceptible. It is especially desirable for chromium plating, as preplating is frequently unnecessary. This effects a saving which often offsets any difference in price between nickel silver and some less ductile metal.

Nickel silver is available not only in ductile sheet for the above uses, but also in leaded sheet and rod for turning, planing and milling. This free cutting stock has almost unlimited use. The rod is adaptable for nuts, bolts, rods, etc., which must withstand corrosion; the sheet is equally suitable for milled articles.

There is a steady demand for nickel silver for the manufacture of trimmings for bars, counters, washrooms and boats, and for many other products which must stand up under hard use and at the same time remain bright though not plated.

Much of the etched ware seen is nickel silver. Clock dials, tags, seals, signs, name plates, novelty ware,

and other articles which are ornamented or inscribed by staging the areas to be retained and etching the remainder down with acid, call for a superior base. Nickel silver qualifies for this exacting need because it can be supplied in an even-grained, blemish-free sheet of almost any size that will take the etch readily and cleanly.

The foregoing are only the main applications of Seymour nickel silver. It is used in elevator doors and grills, and in other architectural art and ornamentation —often in patterns of heroic size! It is extensively used for the manufacture of cylinder lock keys because of its color, rust-resisting properties and smooth milling qualities. It is sold in narrow strip, millions of feet of it, for the manufacture of slide fasteners, where not only its corrosion resistance but also its supreme toughness comes into play. A very large field for nickel silver exists in the manufacture of musical instruments. It is used for the keys and key supports of clarinets, flutes, oboes and saxophones, for the valve stems and coil trusses of trumpets and horns, and for the trimmings of drums, traps, etc. Many dental and surgical appliances are made wholly or partially of nickel silver; and, because of its wonderful ductility, it is used largely for the manufacture of spectacle frames.

In this connection, it may be interesting to explain that, in the production of spectacle frames, a rod of nickel silver 1-1/3 inches in diameter and 12 inches long, encased in pure gold, is drawn to a length of TWO MILES, producing a gold-filled wire 12/1000 inches in diameter! A flaw in the original rod the size of a pin point would under such conditions, elongate to a length of three yards. An important tonnage of the Seymour output of nickel silver goes into optical goods.

Phosphor Bronze and Its Interesting Background

Doubtless no alloy in the annals of man has the long and colorful history of bronze. Fear, courage, love, hate—the entire gamut of human emotions seems to have figured in the long, unbroken "March of Bronze"!

To the half-wild hunter of the Bronze Age, who slew the fierce hairy monsters of his epoch with bronze-tipped spears and arrows, then skinned and cut them up for food and clothing with knives and axes of Bronze, this alloy was more than a mere convenience. It was the preserver of his very existence.

But this primitive was something besides just a miserable, shivering, frightened creature trying to keep alive among bushes and crags. He was truly a man of destiny. For, when one day he accidentally struck a bronze bowl and, finding it gave out a loud, clangerous note, used it to summon his clan, he unwittingly started an industry that was to continue without interruption down to our time. The manufacture of bronze bells has had a noble lineage. To the Chinese of antiquity, the bronze gong was no new thing; and the church bell dates back to 400 A. D.!

Other factors began to speed up the history of bronze. Wars heralded the arrival of heroes and hero worship. This gave rise to another and distinct occupation, the casting of bronze statuary to commemorate the lives and achievements of warriors, statesmen, composers and other idols of public favor.

With wars came also gunpowder, and with gunpowder came the manufacture of bronze cannon. This must have been no half-hearted enterprise, for specimens of these weapons, gracefully proportioned and chased, with rare artistry, may still be seen in public places.

The base of all bronzes was and is copper, alloyed with tin. But many other metals are also alloyed with copper, with and without the presence of tin—such as nickel, zinc, lead, aluminum, phosphor-copper and other metals. So many and varied are the combinations that it is often doubtful whether the mixture belongs to the brass or to the bronze group. It is the purpose of this article to cover only the alloy called phosphor bronze as cast, rolled and drawn in the plant of The Seymour Manufacturing Co. at Seymour, Connecticut.

Modern Phosphor Bronze

Modern phosphor bronze is an alloy of copper, tin and phosphorous. The proportions vary somewhat for different requirements, but generally they are approximately 95% copper, 4¾% tin and ¼% phosphorus. Though added in relatively minute quantity, the phosphorus plays a vital role by deoxidizing the alloy, thus materially assisting it to withstand corrosion. So important is this bit of strange metal that, until it was introduced into the mixture, the production of phosphor bronze as we know it was not possible.

Originally, the phosphorus was added to the molten copper and tin in its natural form. This required skill on the part of the operator in order to get it well submerged within the bath. Later it was combined with copper in special laboratories set up for that purpose, and now this phosphor-copper is provided in "waffle" form, squares of which are broken off and added to the bath as needed.

Fig. 3. An Annealing Furnace

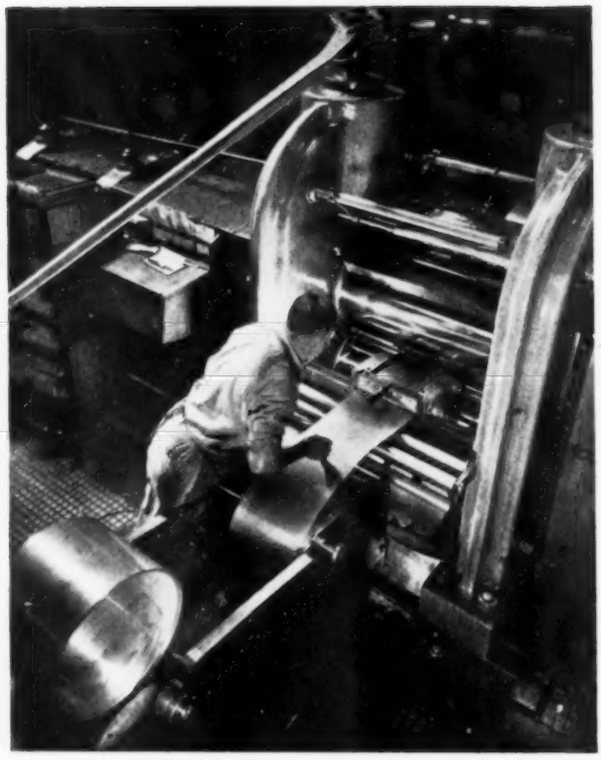

Fig. 4. Finish Rolling

Properties and Uses

The principal characteristics of phosphor bronze are (1) high resistance to corrosion and to the disintegration caused by salt air; (2) a toughness that enables it to withstand long-continued friction and abrasion; (3) an extreme resiliency which endures under almost endless cycles of "fatigue" stress; (4) a practical indifference to sudden thermal change; and (5) an almost negligible tendency to spark when struck, and it is comparatively low arcing when electrically charged.

Phosphor bronze is produced in sheet, wire and rod. A very large tonnage is used in electrical switches and other electrical devices. Its stubborn ability to stand up under grilling "fatigue" makes it a very superior material for contact springs in snap switches. In the heavier types of high voltage snap switches the rotating assemblies are driven into contact with terrific force by strong coiled springs. The leaves must grip the tongue firmly, and this grip must remain at peak effectiveness for the life of the switch, which is often many years. To insure this service, manufacturers of switches often demand a "fatigue" test of at least 50,000 impacts, sometimes more, before accepting the raw stock.

Phosphor bronze makes an efficient material for bearings, bushings, slides, cams, sleeves, nuts, bolts—in fact, for any assembly that must not "freeze" in service. Its resistance to corrosion, along with an extreme toughness, fits phosphor bronze wire for the weaving of wire cloth, screens and riddles.

Heavy plates of phosphor bronze are used for bearings between the piers and spans of bridges, to accommodate the expansion and contraction between the sections of the bridge which is caused by the heat of summer and the cold of winter.

In sheet, strip, wire and rod, phosphor bronze finds many more uses in industry where its special properties are factors. It is used for parts in water meters, clocks, pumps, scientific instruments used at sea or in other moist surroundings, thermal couples, ignition systems, lamp sockets, as friction discs of clutches, and for film roll spool springs in cameras.

Plant and Methods of Operation

The plant of The Seymour Manufacturing Co. is composed of these principal departments: (1) Casting Shop; (2) Sheet Rolling Mill; (3) Wire and Rod Mill; (4) Testing Laboratory.

In the Casting Shop, the bulk of the melting is done in a battery of Ajax-Wyatt Electric Furnaces of the induction type. These furnaces are lined with "Shamva" Mullite, a 3300° Super Refractory manufactured from a mineral imported from India. Prominent characteristics of this type of furnace are simplicity of design, perfect temperature control, and automatic circulation of the metal bath. The combined capacity of the battery is 60 tons per day. These furnaces feed into a gang of metal molds mounted on a turntable, for both the round and the flat castings. For special melts, crucible pit furnaces are employed. Only the highest grades of raw materials are used, such as electrolytic nickel, highest quality spelter, electrolytic copper and Straits tin. However, to make sure of a perfect start, samples of every batch are cut and checked for grain structure. When found satisfactory, the flat slabs go to the Sheet Rolling Mill and the rounds to the Wire and Rod Mill.

The equipment in the Sheet Rolling Mill includes eighteen stands of rolls, annealing furnaces, slab millers, flatteners, shears, and other equipment necessary for the proper finishing and dimensioning of the mill product. The routing in this mill is as follows:

The flat bars are first broken down; that is, passed between rolls to give them uniform thickness. When they emerge from this breaking down, they still have the original skin, containing scale, oxides, and other impurities from the casting operation. To remove this completely, they are milled, or overhauled. This removes the skin with all extraneous matter, leaving nothing to be rolled into the grain in succeeding operations. The subsequent rollings and annealings bring the sheet to approximately the thickness desired. The exact gauge is then achieved in the finish rolling, after which the sheet is slit or sheared to required dimensions.

Exceptional care is taken in the Seymour plant in the finish rolling to make sure that accurate gauges are maintained. This often involves extra cost, but it produces stock that the fabricator can work directly into his product without resizing. Maintenance of accurate gauges naturally calls for modern equipment kept at top efficiency, as well as unrelenting vigilance on the part of the operators—all of which, we are assured has been reduced to rule and precept in the Seymour plant. Where the sheet or strip has to be absolutely flat, it is put through a patented leveling operation, then polished or buffed as desired. Sheet is also supplied in circles.

As rolling and drawing nickel silver and phosphor bronze tends to harden these alloys, anneals are necessary between operations to restore the original softness and ductility, followed by picklings to remove surface oxides. The annealing, pickling and washing

equipment of the Seymour plant is modern, thoroughgoing and speedy.

The final operation in the manufacture of sheet is inspecting and packing. Each individual piece manufactured in the Seymour plant is examined. Discolorings, grain irregularities, abrasions, or other blemishes, if found on either side, are marked and the sheet thrown out. This program is drastic, but it is essential to the maintenance of the high level of quality

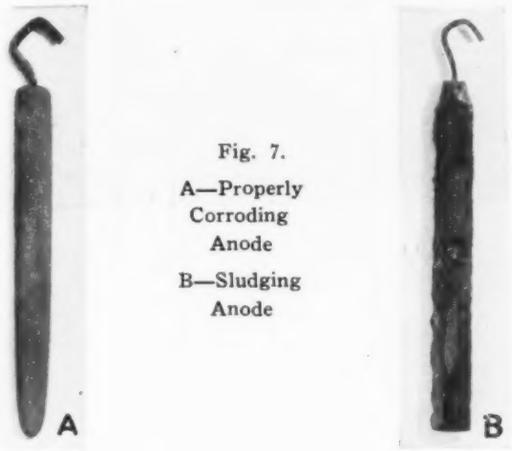

Fig. 7.
A—Properly Corroding Anode
B—Sludging Anode

of output insisted upon by this particular manufacturer.

In the manufacture of rod and wire, the routine, though related in principle to that of sheet, has its own interesting departures. The rounds are first overhauled and the "fins" left by the molds carefully milled off. It is highly important that all traces of "fin" be removed. If left on, a "fin" would show up as a longitudinal blemish, no matter how fine the stock might be drawn.

The rounds are next passed through rolls to reduce the cross section and bring them to uniform diameter. They are then pointed at one end to facilitate insertion into the die of the bull block, where they receive several drawing operations.

Following these and before the finishing draws, the coil, with others, is "thrashed"; that is, it is tumbled in a huge revolving barrel-like drum containing a mixture, which acts as a polisher and acid absorbent. After this "thrashing," the load is discharged and drenched with clear water, revealing coils with a very bright polished surface. From here on, the wire is drawn on various blocks to whatever sizes are required.

Several types of dies are needed to produce nickel silver and phosphor bronze wire and rod; steel dies,and tungsten carbide and diamond dies for the finer sizes. Like the sheet, the round stock hardens from the drawing. Consequently, frequent anneals and picklings are necessary all along the line.

The final operation is coiling, or cutting to length. The success of the coiling operation depends entirely upon the accuracy with which the dies are lined up, and much care is taken to produce coils having a "cast" which will not give trouble to the man who has to use them in fabrication. Where the wire is delivered in cut lengths, these lengths are straightened in a special machine and then specially packed to arrive in perfect condition.

In addition to round wire and rod, almost any geometric design may be had in the Seymour product. A heavy tonnage of shaped nickel silver wire is produced each year, such as flat wire with round or square edges, oval, half oval, quarter oval, half round, quarter round, triangular, hexagon, square, rectangular, and Keystone or wedge-shaped. A large part of this shaped stock goes into the manufacture of jewelry and product ornamentation, also into scientific instruments and equipment.

The Anode Plant

Some years ago, The Seymour Manufacturing Co. established a separate plant for the manufacture of anodes for plating. These are made of nickel, copper, brass, bronze and zinc, with special concentration upon nickel anodes. Contact with platers throughout the country has convinced the company that the main trouble with anodes is uneven corrosion, with its attendant waste from excessive sludge. In order to avoid this trouble, they have gone to great lengths to produce anodes that have even, homogeneous grain. To accomplish this, nothing but virgin material is used. This is melted in a modern electric furnace and poured under accurate pyrometric control, after which the mix is carefully tested in the laboratory for crystal structure. No lot is passed unless the grain accords with a set standard of excellence.

An example of what this rigid "grain control" accomplishes is shown by the two accompanying illustrations. "A" is a Seymour "Controlled Grain" Nickel Anode in process of corrosion. The surface remains smooth and free of pits—a type of corrosion which will continue in this even manner until the anode is entirely consumed.

The reverse of this is shown at "B". Here the crystals were separated by foreign matter, which, under electrolytic action, washed out, dropped to the bottom of the tank and formed sludge (waste). The corrosion, instead of confining itself to a surface etch, made rapid strides towards the center of the anode as fast

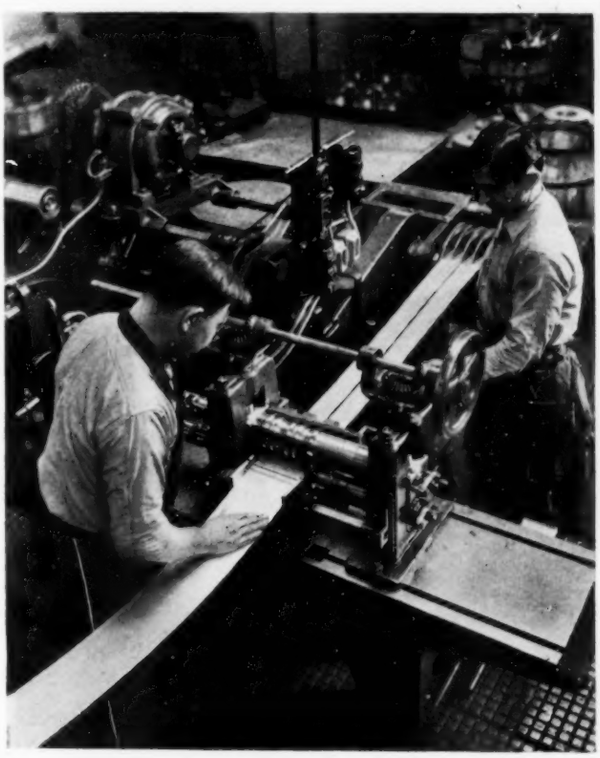

Fig. 5. The Slitting Operation

as openings developed. Had action continued very much longer, this anode would have been severed.

Seymour nickel anodes are made in four types: 99%+ Rolled Depolarized; 99%+ Cast Oxide Depolarized; 99%+ Cast Carbon; 95-97% Cast. Every shape in common use in plating establishments, unless restricted by design patent, is available in Seymour anodes. Among these are Two Bar, Hexagon, Round, Diamond, Elliptic (Oval), Curved Elliptic and Curved Hexagon, Pear, Barrel Type, Flat, Corrugated and Circular.

However, by far the greatest number of anodes used today are of the Elliptic type or a variant. This is because the Elliptic has the large surface which is essential to good conductance, proper current distribution, and the maintenance of the metal content of the bath. Being active over practically its entire surface, the Elliptic dissolves evenly. As this type can be purchased in any commercial length, no portion of it need be out of the line of feed and, therefore, unusable. The Round shapes have somewhat the same qualities as the Elliptic, except that in proportion to the space they occupy, they do not present so much surface to the action of the bath. Next to the Elliptic and the Round in efficiency, are the Hexagon types, which are rapid feeders.

Two-Bar anodes are favored by many platers because of their relatively large surface and the presence of but one hook. Of these, the longer sizes are made slightly tapering. The Curved anodes have proved their worth in all cases of barrel plating; they afford in their curved form many of the advantages of the straight bar Elliptic and Hexagon anodes, such as even feeding, even deposit, long life, and minimum scrap.

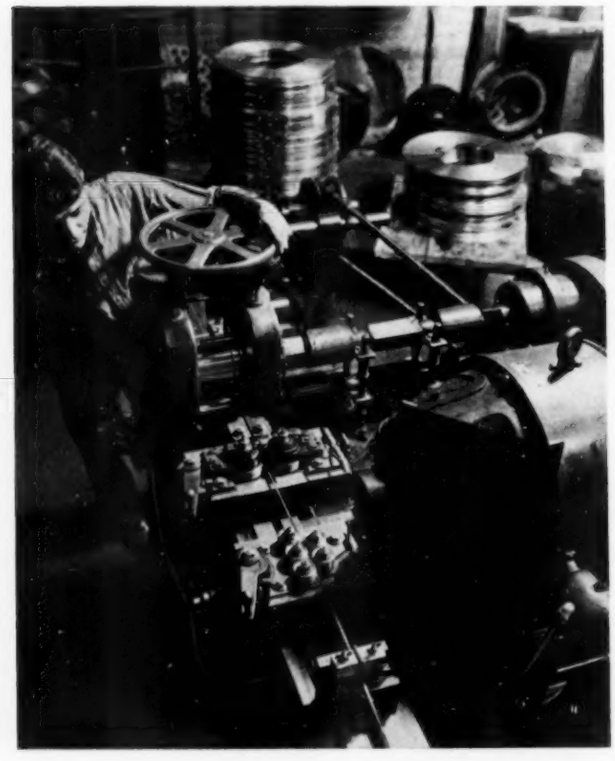

Fig. 6. Rolling Round Edge Wire

Fig. 7. A Corner of the Laboratory

Where tank length is not at a premium, Flat anodes are very efficient, presenting a large active surface in comparison with their weight.

The Seymour Testing Laboratory

The Seymour laboratory is a department fully equipped for testing every Seymour product. It is the "eagle eye" that watches over the entire output. Under its direction, a chemical analysis is made of every melting batch that leaves the Casting Shop. The batch is then numbered for identification and throughout its journey through the various manufacturing processes, the laboratory makes physical and metallographic tests for grain structure, hardness, tensile strength and ductility. If a sample at any time fails to qualify, that lot is located by its number and promptly withdrawn from circulation.

Conclusion

Due to limitations of space, the foregoing can no more than sketch the general plan and character of the plants of The Seymour Manufacturing Co. This company, therefore, extends a hearty welcome to all visitors who may wish to visit the various departments.

Deterioration of Chromic Acid Baths Used for Anodic Oxidation of Aluminum Alloys

Commercial practice has shown that chromic acid baths for anodizing aluminum eventually fail. R. W. Buzzard and J. H. Wilson in the January number of the Journal of Research (RP961) of the National Bureau of Standards, Washington, D. C. show that aluminum and chromium compounds are the controlling factors in the bath breakdown. They found that the film quality is dependent on the available or free chromic acid. Control of the pH of the bath by chromic acid additions is a very good method of holding the free chromic acid concentration at a desired value.

Removing Stains From Brass Coils

By A. G. AREND
Glasgow, Scotland

Stains Caused by Annealing in Fuel-Fired Ovens Can Be Easily Removed Electrolytically.

PROBABLY one of the most disconcerting features experienced in the making of brass coils, is that the finished product not infrequently displays stains which more or less spoil the finished appearance.

If all stages of the annealing and heat treatment are carefully controlled, such staining will not appear, as one of the common sources of the trouble lies in the manner in which the flames impinge on the face of the metal.

The modern electric re-heating, and annealing furnaces obviate these difficulties, but it has to be acknowledged that many firms at the present time, adhere to the cheaper forms of fuel.

One of the outstanding claims of most makers of electric hearths is that the metal will show no evidence of burning or staining in any way, and this claim is thoroughly justified.

For economical reasons the earlier type of firing is persevered with, but if this is supplemented by a sound means of removing all scale or staining, most of the practical difficulties will be obviated.

Earlier research work was largely devoted to immersing the finished coils in what was thought to be suitable solvent solutions, but this system was very far in error, because the slight amount of zinc removed was almost invariably able to deposit metallic copper.

In a similar manner, gun-metal tubes when subjected to pickling, caused the tin to react with the copper in a like manner. Accordingly, the stains and scale were removed, but at the expense of the general appearance, since the copper was only loosely adherent, and thus patches of copper required to be removed. This led to the use of very dilute solvents, which were applied for specific periods, at a definite temperature, whereby the oxidized portion only was affected.

Where the burning of the annealing flame was sufficient to form a hard or strongly adherent stain, there was no alternative but to continue the treatment, or use a more concentrated solution, which thus tended to dissolve metallic zinc from the surface and deposit the copper. As will be readily understood, the somewhat awkward shape of brass coils which are to be used for different heating purposes, does not make it an easy proposition to clean them thoroughly.

There is nothing original in using solutions of nitric and sulphuric acids, or alternatively, mixtures of sulphuric acid and potassium dichromate.

(Sodium dichromate is preferred to the potassium salt, not because of the slight economy gained, but because of the greater solubility.)

After much investigation, it was realized that irrespective of what mixtures were used, in practically all cases, the brass was attacked, without any preferential action upon either component.

Details of manipulating the solutions are as follows: The brass coils must be kept in constant motion, any rise in temperature avoided, and the coils periodically removed for washing, whilst a sloping earthenware bath is recommended, so that the metal will be offered better opportunities of draining.

This meant that much attention was necessary, and accordingly a much more systematic process was introduced which could operate without attention, and could be relied upon to remove all stains and scale.

The Process

A short survey of the different makes of brass coils will reveal that the majority, although differing widely in dimensions, bore, etc., represent a cylindrical object as a whole. This satisfies one of the general requirements of simple electrolytic work, as an anode made of this shape is easily accompanied by a cathode of similar shape but smaller diameter. If the brass coil is used in the capacity of anode, the latter will be exposed to the action of the current, whereas the cathode, which may be represented by a canister, will be practically immune from attack. The rate at which a metal will dissolve in an acid is generally increased by the application of current, and as the desire is simply to remove the stains present, this action might be thought somewhat superfluous. But an acid electrolyte is not used.

A solution is made up of caustic soda and sodium chloride, the proportions of which can be found only by practice, which however, only takes a few minutes to ascertain. When used as an electrolyte in presence of the brass coil, the current causes bubbles of gas to evolve, but not being an acid solution no appreciable corrosion will ensue.

The sodium chloride meanwhile evolves chlorine which instantly attacks the stained part, but if too much of this reagent is prestent the coils might show a corroded appearance when finished.

For this reason, the usual custom is to use an electrolyte of dilute caustic soda, about 8%, and add the solution of salt as the action progresses.

The stain which is generally red is chiefly composed of cuprous and cupric oxides, which disappear in the

electrolyte. The canister which is used as the cathode is kept at a distance of about 2 inches from the inner extremity of the coils.

This means that the action is more pronounced at inner edges, but if the work is conducted in a cylindrical metal vat, the sides of which are also 2 inches from the outer extremity of the coils, and connected to the cathode cable, the attack will proceed from both sides. Should the tubes be of one inch bore, the action is almost the same throughout, but with 2 inch bore tubes, the furthest extremity is only 3 inches, which is well within the scope of the current.

Thus the stains existing on top or bottom sections of the coils are more or less attacked alike.

The small proportion of copper which has been dislodged from the stained parts will ultimately appear as a slight deposit on both canister and sides of the vat. As a rule, even after several coils have been treated, only a faint tint of red is apparent on the former, since although spoiling the appearance, the total amount of copper oxidized is really trifling.

One small coppersmith who made a specialty of brass coils carried out this work with current derived from a set of accumulators. In larger factories where numerous coils have to be dealt with, a regular source of direct current is necessary, but the total current consumption is very small.

When handling an open form of object such as a coil, the usual system of calculating the necessary current must be ignored, as no efforts are being made at deposition work. Calculation can only be roughly made on the square area of the canister and the metal vat. A coil one foot in height, and 10 inches in diameter, (i.e. diameter to the extremity of the coil) will require a vat plus canister, with a square area of 7 square feet, and this may be taken as a sufficient standard.

By applying a current of 5 amps. per square foot, this means a total amperage of 35.

With coils of low bore tubing the voltage rise is not appreciable, but with tubes 2 inches in bore, the voltage can go up to 12 volts and more, which thus increases the current consumption, and makes it somewhat difficult to deal with accumulators.

In factories engaged daily in making brass coils, a small converter is used to convert a section of the regular alternating current supply from the mains, and this is used for the foregoing purpose.

When the proper conditions are used, the stains disappear from the brass in a matter of a few minutes, even although these may have been of the most undesirable bright red color.

The apparatus used is of the simplest order, and simply consists of a cylindrical metal vat and inner canister connected by terminals to the respective cables, leading to the bus bars. The vat is laid on some form of mat to prevent grounding of the current, but otherwise no precautions are necessary. Best results are secured by having ammeter and voltmeter attached, but success does not depend on any specific current so long as this is not excessive.

What happens when the current reacts, is that the metal section behind the stained part emits bubbles charged with chlorine which dissolve the oxides.

It has been pointed out that the sodium hydrate in the electrolyte can cause the dissolved copper to deposit in the form of hydrate, but this is dependent upon intermittent applications of the current, since once the copper has reached the cathode, the sodium hydrate cannot influence it.

After several coils have been treated, it will be found necessary to replenish the sodium chloride content of the electrolyte, since this has been decomposed to sodium hydrate and free chlorine.

The foregoing process was applied to a wide variety of gun-metal, and brass coils, and removed all stains with precision and accuracy.

Vacuum Pouring for Extrusion of Lead Sheathing

CABLE sheathing produced by extrusion on the inverted type press (stationary cylinder and moving ram) was occasionally found to break down for no very apparent reason. Intensive investigation showed, however, that the structure of such sheathing was often characterized by a typical lack of homogeneity, particularly in the region commonly referred to as the charge weld, **i.e.**, the junction between the last part of one charge and the first part of the next. While no definite conclusions have been arrived at as to the cause of the fine grained structure found localized at various points in this region, it appears likely that entrapped oxide skins and gas bubbles may be responsible, since even prolonged heating will cause no grain growth, in spite of the fact that the recrystallization temperature of lead lies below room temperature; the inclusions would cause a permanent mechanical hindrance to growth. By the use of a non-oxidizing atmosphere in the cylinder and over the stream of lead entering the cylinder, some success was achieved in preventing the formation of oxide films, but difficulties arose due to foaming.

Vacuum pouring was next attempted with very successful results, some modifications being made to the plant for the purpose; a hood made of boiler plate and provided with a quick release clamp is positioned over the charging end of the cylinder, the ram passing through it and being well packed to prevent ingress of air. Entering the side of the hood is the mouth of the lead kettle, which is electrically heated and brazed in. Positioned beneath the hood are two electrically-heated plates which serve to remove the skull of solidified lead which tends to collect above the nose of the ram when the press is operated. A high vacuum is maintained in spout, hood, and cylinder when the press is working. Perfectly homogeneous structure is found in the sheath extruded.

For the normal type of press, the stationary ram is drilled to take connections for the vacuum pump and the lead kettle. It is interesting to note that in this case the lead is taken from the bottom of the kettle, and that pig lead added to this latter is immersed slowly in wire baskets to prevent churning of the contents and trapping of gas bubbles and oxide particles. Furthermore, means have been developed to dispense with lubricating of the ram and cylinder and so to avoid any chance of contaminating the charge. More complete details of the plant are contained in the original paper presented by Atkinson before the Wire Association at Cleveland.

Melting and Casting of Aluminum Bronzes

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Difficulties Encountered and Methods of Overcoming Them in Practical Foundry Operations.

CORRECTLY alloyed, melted and cast aluminum bronzes (not aluminum brasses) represent one of the most valuable groups of modern foundry products. Their mechanical and chemical (anti-corrosive) properties, particularly their resistance to atmospheric and chemical influences, frequently render these alloys more suitable for certain technical purposes than the much more expensive tin bronzes.

However, aluminum bronzes exhibit certain characteristic properties which tend to render the production of perfect castings rather difficult, especially if these are of greatly varying cross section or of relatively large size. This is due chiefly to the exceptionally high shrinkage of these alloys and to their tendency to foam if agitated and to form porous and unsound castings. The difficulties inherent in aluminum bronzes resemble those encountered in the production of aluminum brasses on the whole, although porosity and foaming tendencies are much more pronounced if the basic rules of treatment are not strictly adhered to.

Alloys of this type contain, besides copper, from 9 to 10 per cent aluminum, up to about 5.5 per cent iron and nickel, and from 3 to 4 per cent manganese. Zinc, lead and, particularly, silicon are usually considered undesirable impurities, although lead in amounts of up to 2 per cent is frequently added to improve the machining qualities of the alloys.

It will be shown below that the production of small and medium castings of this type is a matter of proper melting and casting treatment only, and that serious difficulties are encountered only if the instructions given below are not strictly followed. More difficult, however, is the production of heavy castings which, if poured into sand, solidify comparatively slowly, these difficulties being due chiefly to a characteristic transformation of the metallic structure. This unfortunate property is shared by a number of other copper alloys, but it is particularly evident in "true" aluminum bronzes (the term "aluminum bronzes" being frequently, but incorrectly, applied to aluminum brasses).

Crystal Structure

This unfavorable crystalline transformation of aluminum bronze castings at excessively slow solidification and cooling can be observed in the fracture with the unaided eye, the originally fine grained structure having changed into coarse grains. This is due to the decomposition of the desirable beta-structure into the two stable alpha- and delta-components. The beta-structure is very strong and hard, at relatively high elongation, the alpha constituent is soft and ductile while the delta-structure is extremely hard and brittle. However, the most serious disadvantage of this crystalline modification of the structure is the fact that the new structure is made up chiefly of laminated layers, that is to say, similar to the pearlite in steel. The lower the cooling speed of these aluminum bronzes, the coarser is the final structure of the casting and the more pronounced its weakness; the breaking strength along the border line between the different layers is very low, and comparatively weak impact stresses may cause rupture of the castings.

The formation of this alpha-delta structure can be prevented by one of the following three alternatives:

1. The metal is cast in chill molds.
2. If poured in sand the casting is freed from the sand directly after solidification and permitted to cool in the air.
3. Addition of 2 to 3 per cent of iron or nickel to the alloy.

A fourth alternative has also been suggested, that is, the lowering of the aluminum contents to 8 per cent. It is true that the detrimental modification of the structure can be avoided by this measure, but this would also rob these alloys of their most characteristic advantages. And since it is possible to attain equally satisfactory results without interfering with the characteristic properties of these alloys, this fourth alternative cannot be seriously considered.

The Addition of Iron

Referring to the third alternative, that is, to the addition of 3 to 4 per cent iron to the alloy, it must be admitted that the protective influence of this addition is not absolute, although the detrimental influence of slow cooling is largely neutralized, while in castings of less than 4" to 6" diameter this percentage of iron will suffice to entirely suppress structural modification of this type. Since in heavier castings the protective influence of iron is not quite as pronounced (even if the percentage of iron is raised to 5%) and since uncertainty in this respect means a large percentage of bad castings, larger castings must be cooled off as rapidly as possible even if iron is present, a chief advantage of iron then being its modifying, or partly suppressing, influence on the detrimental structural changes.

The favorable influence of iron is considerably improved if about 1 per cent of nickel is also added. A small percentage of manganese also tends to im-

prove conditions, the united influence of these three constituents not only tending to neutralize the inclination of the beta-structure towards decomposition but to improve the general mechanical properties of the castings.

The favorable effects of the iron also extend to the anti-corrosive properties of the aluminum bronze castings, increasing their resistance to water and atmospheric influences considerably. The average tensile strength of castings obtained by the addition of about 3 per cent of iron is approximately 38,000 to 42,000 lbs./sq. in., at a breaking strength of about 14,000 lbs./sq. in. and an elongation of 20 per cent. Mention should also be made of the fact that the addition of 3 per cent of iron exerts a very favorable influence on the properties of die cast aluminum bronzes of this type, the combined effect of the very rapid cooling action of the die casting molds and the refining influences of iron yielding castings of exceptional properties.

The hot working properties of aluminum bronzes are also improved by the addition of about 3 per cent of iron, although much higher percentages should be avoided, if possible.

The favorable influence of nickel additions besides iron is chiefly due to a certain neutralizing effect on the decomposing tendencies of the beta-structure at slow cooling and to the increase of density of the structure in presence of iron and nickel, a feature of special significance where the castings are to be subjected to hydraulic pressure. These nickel additions are sometimes carried to 7 per cent or even more, particularly in connection with heavy castings, since these high nickel contents are claimed to suppress absolutely all tendency of the beta-structure to decompose into alpha and delta constituents. However, apart from being rather expensive, these high nickel additions to aluminum bronzes also introduce definite disadvantages, so that for all practical purposes the nickel contents should not exceed about 2 or, at the most, 3 per cent.

The distrust directed against the addition of iron to all copper alloys by most foundrymen is absolutely misplaced in this instance. The difficulties frequently encountered with the addition of iron to other copper alloys are due to the presence of iron carbide in the iron, which is not decomposed, forming exceedingly hard surface inclusions in the castings. However, in view of the fact that aluminum decomposes these carbides, this danger does not exist in the case of these aluminum bronzes, and the alloys produced are absolutely free from hard spots and other faults occasioned by the presence of iron carbide.

Cooling Casting in Air

Regarding the second alternative mentioned above, i.e., the exposure of the casting to the cooling influence of the atmosphere directly after solidification, it is obvious that this method offers a number of practical disadvantages. It is very difficult in the first place to determine the correct time of removing the molding sand if the castings are comparatively heavy or of varying thickness. The sooner the casting is exposed the less pronounced is the effect of the structural changes, but the molding sand must not be removed one minute too soon if serious difficulties of obvious nature such as bleeding, etc., are to be avoided. It is for this reason that some foundries prefer to wait a few minutes longer than absolutely necessary and to make up this loss by accelerating the rate of cooling. In the case of very complicated castings this is effected by a current of compressed air while simpler shapes are chilled by water sprinkling. Under ordinary circumstances this radical chilling does not impair the quality of the castings, one of the important technical properties of these alloys being their exceptional strength and toughness at red heat.

General foundry conditions permitting, the molding sand is not even removed from the casting before chilling with water, the entire mold being sprayed with water after removing the frames until all the sand has been washed off and the casting cooled to room temperature. This method offers the advantage that bleeding of the casting is avoided. The only remaining disadvantage of this chilling process is that if chilling is carried out too soon, the sudden interruptions of the exchange of liquid metal within the casting may cause the formation of pores and blow holes.

Casting in Chill Molds

All the disadvantages of this type inherent in sand castings are avoided if the metal is cast in chill molds, and if large quantities of castings of identical shape are to be produced, these alloys should always be cast in chill molds, particularly where heavy or complicated castings are made. Some of the other disadvantages exhibited by sand cast aluminum bronzes are also eliminated by chill casting, and since these alloys have a rather large range of pouring temperatures, they are well suited for this purpose.

The average pouring temperature for chill casting is 2,200 to 2,250° F., the preheating temperature of the mold being about 425 to 525° F., depending on the shape and weight of the casting. Attention should be paid to the fundamental rule that the mechanical properties are improved with decreasing pouring temperatures as long as these are sufficiently high to yield a dense and true casting. The same applies to the preheating temperature of the mold. The lower the mold temperature the more rapid is the cooling of the casting, and the more satisfactory the technological properties, provided that the interaction of excessively low metal and mold temperatures does not cause premature solidification of the casting.

The very high degree of shrinkage of the average aluminum bronzes causes correspondingly strong suction of the metal, so that it is absolutely necessary in chill casting these bronzes to maintain a reserve of highly heated metal in a special crucible from which the casting can be fed until the metal has completely solidified. It is possible only by this means to obtain chill castings free from porosities and blow holes.

In designing the molds, particular attention must be paid to the arrangement of the heads which must be sufficiently large to take up the oxide and impurities present in the metal. These feeding heads must not be attached to some thin-walled section of the mold—as is frequently done to facilitate the removal of the heads—but to some heavy section which can then serve as a feeding center to the lighter sections. The number of feeding heads must conform to the number of such logical feeding centers, of course. Other requirements will be taken up in connection with the discussion of sand casting which exhibits some general features shared by chill castings.

Effect of Manganese

Before taking up the problem of sand casting aluminum bronzes it may be in order to offer a few comments on the effect of **manganese** in these alloys. It is a common experience in most professions that the enthusiasm following the introduction of a new method or idea is often succeeded by a reaction just as radical as the previous enthusiasm. This applies also to the introduction of manganese as a constituent of aluminum bronzes which after a few years of enthusiastic praise has been criticized into oblivion later on, the chief reason for the adverse criticism being that in view of the high degree of affinity of aluminum, manganese could not possibly act as an efficient deoxidizing agent. This argument is not to the point, however, since manganese may just as well develop effects apart from deoxidation as any other constituent of aluminum bronze. Experience has shown, for instance, that the judicious use of manganese in connection with iron and nickel tends to improve elongation and reduction of area considerably. It has been possible, for instance, by adding 0.30 per cent of manganese to an aluminum bronze containing about 10 per cent of aluminum to increase the elongation from 18 to 45 per cent, with a corresponding increase of area of from 20 to 42 per cent. The most important feature of this increase of ductility is that the tensile strength remains almost stationary while the elastic limit suffers only a comparatively small reduction.

This advantage is accompanied by the serious disadvantage, however, that the sensitivity of the aluminum bronzes towards fluctuations of the casting process is noticeably increased. Indeed, it is necessary in presence of 1 or 2 per cent of manganese to carry out the entire melting and casting process in close adherence to a definite routine. Wherever this is possible, correctly determined additions of manganese will be found to be very beneficial in every respect.

Alloying Practice

Only new metals can be employed in the production of these alloys. A small percentage of foundry scrap, risers, etc., can be used indirectly, that is to say, if the carefully cleaned scrap is first remelted and cast in blocks. A certain limited quantity of these ingots, not exceeding 15 per cent of the total weight of the charge, can be added.

The order of charging is: copper, (nickel, manganese, iron, etc.), scrap, aluminum. The copper is first melted down under a layer of common salt and heated to about 2,100° F. A small amount of phosphor-copper is then added to deoxidize the copper. The special additions, such as nickel, iron, manganese, etc., must be added in form of suitable hardeners. Iron and manganese are advantageously added in form of aluminum alloys containing 20 per cent of manganese or 10 per cent of iron respectively. Nickel is added as copper-nickel alloy.

These hardeners usually contain all of the aluminum required for the aluminum bronze. If a small amount of aluminum remains to be added, it should not be charged in the elementary state but as aluminum-copper hardener containing 50 per cent of copper.

Of the various hardeners enumerated above, the copper-nickel hardener should be added first, followed by the aluminum-manganese hardener (melting point about 1,600° F.), the aluminum-iron hardener (m.p. 1,575° F.) and the aluminum-copper hardener (m.p. 1,075° F.) in the order named. Where the various aluminum hardeners are not available, the corresponding copper base hardener must be emlpoyed, although the initial temperature of the copper must then be raised from 2,100° to about 2,250° F. to ensure sufficiently rapid melting periods. It is also necessary in this case to add another small portion of phosphor-copper directly previous to the final addition of aluminum, since the presence of even the slightest amount of aluminum oxide in these alloys would seriously interfere with their properties. Secondary aluminum must under no condition be added to aluminum bronze alloys, only the best commercial virgin brands giving continuously reliable results.

Where, in spite of these precautions, the properties of these castings do not come up to expectations, noticeable improvements are frequently effected by first pouring the alloy into ingots and remelting them under a cover of salt or salt-charcoal mixture, the superior results obtained with these remelted alloys being due chiefly to the improved homogeneity of the metal.

The pouring temperatures are governed chiefly by the size and the dimensions of the castings as well as by the type of mold employed. They should not be higher than necessary to completely fill the molds. The basic casting temperature for alloys of this type is 2,150° to 2,200° F. They are somewhat higher in the case of thin-walled, complicated castings, and lower for thick walled castings of similar weight.

Molding and Pouring Practice

Satisfactory aluminum bronze castings can be obtained only if molding and pouring is carried out with due attention to the characteristic properties of these alloys. The chief difficulties to be considered in molding are:

1. The tendency of the aluminum bronze to form if agitated.
2. The affinity of these alloys for atmospheric oxygen.
3. Their exceptionally high degree of shrinkage.
4. The dependency of the mechanical properties of the castings on cross-section, that is to say, on the speed of cooling of the castings, or of the individual parts of the castings respectively.

It is necessary in the first place, therefore, to provide for sprues and gates as well as for risers of ample width and correct cross section. It is advantageous also to fit a sump on top of the sprue as shown in Figure 1. If this sump is not permitted

Fig. 1. Sump at Head of Sprue

to be drained empty during pouring, the metal flows down the sprue in an even stream, foam and slag collecting at the surface of the sump metal. Still better results are obtained with a type of sump shown

in Figure 2 which is characterized by a skimmer plate inserted between the sump proper and the mouth of the sprue. If correctly placed, this skimmer will

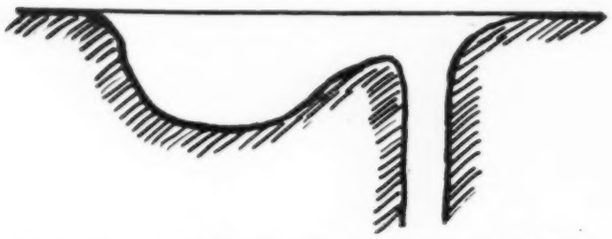

Fig. 2. Sump with High Skimmer Plate at Mouth of Sprue

hold back every trace of slag and foam produced during pouring.

However, while this precaution will keep the castings free from slag inclusions, foam can also be produced by originally dense metal within the mold, chief factors being eddying movements and excessively rapid flow of the metal, moisture in the molds and any other agencies causing strong agitation of the aluminum bronze directly previous to solidification. The gates must therefore be arranged so as to induce quiet and uniform flow of metal into the mold

Fig. 3. Wrong Type of Horn Gate

center. Corners and edges should be rounded off, where possible, to avoid eddies. While the cross section of the gates should be as large as possible under existing conditions, they should be made flat rather than high, although maximum density of these castings is produced with bottom pouring. The horn gates shown in Figure 3 sould not be employed for this purpose, however, since this would cause the metal to emerge from the gate under maximum static pressure which is bound to induce spraying of the

Fig. 4. Improved Horn Gate

metal within the empty mold, and eddying after this has been partly filled. The opening into the mold center must therefore be made ample and somewhat funnel shaped (Figure 4), although it is advisable, where possible, not to provide a vertical gate but an oblique gate of the type shown in Figure 5.

The gate must be directed so that the metal entering the mold center does not impinge upon the core or on a projecting part of the wall, which is bound to cause foaming in an aluminum bronze.

Where for one reason or another bottom pouring does not appear practicable, attention must be paid to the construction of the sprue, which must be designed with a view to ensure uniform and even descent

Fig. 5. Oblique Horn Gate

of the metal and to avoid too violent a flow through the sprue and into the mold center. This can be effected best by breaking the flow of metal as indicated by Figures 6 or 7 and by balancing the intake of the sprue and the outlet of the gate against each other so that the metal in the sprue forms a solid column without interruptions, or hollow spaces, at

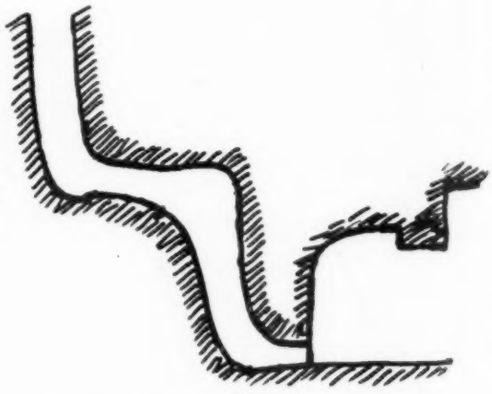

Fig. 6. Gating to Prevent Washing Away

the breaks. This, as well as the shape of the breaks, or knees, shown in Figure 6 also prevent the descending metal from washing away part of the molding

Fig. 7. Another Type of Gate to Prevent Washing Away

sand forming the sprue walls and causing contamination of the castings.

Foaming and drossing of aluminum bronzes may also be caused by the moisture contents of the molds

and, indirectly, by the density or venting qualities, of the mold walls. It is obvious that in view of the foaming tendencies of these alloys the action of large quantities of superheated steam on the hot metal, and the strong agitation induced, the castings are bound to be drossy and porous. It is necessary therefore to reduce the percentage of water used in the molding sand to the minimum required for molding purposes and to tamp the mold as loosely as possible, providing also for as many vents as are practicable under the conditions involved. Very good results can be attained by washing the interior mold surfaces with a thin graphite emulsion and by surface-drying the mold directly previous to pouring by means of a soldering torch. It is advisable in making up the graphite emulsion to add about 3 to 5 parts of core gum solution per 100 parts of graphite which improves the adhesion and the integrity of the wash during pouring.

It is obvious from the above deductions that the chief requirement of pouring aluminum bronzes is the avoidance of all forms and causes of agitation. If by one means or another (it is impossible here to recount all the numerous tricks and means of attaining this end) the bronze can be poured without causing any agitation whatever, and if melting and pouring are carried out satisfactorily, the casings are bound to come out faultlessly. However, since even with most perfect methods foaming and drossing of aluminum bronzes cannot be entirely prevented, it becomes incumbent upon the molders or patternmakers to make suitable provisions against this eventuality. Wherever certain sides of the castings have to be faultless in preference to other sides, it is advisable to have them undermost in the mold, dross and impurities of the bronze rising to the top of the metal always. Where the preferential sides are on opposite side of the castings, sufficient allowance should be provided at the top side for machining and finishing purposes. Attention must also be paid to the fact that the shrinkage of these bronzes amounts to 1.8 to 2.0 per cent. Apart from the usual measures adopted in molding high shrinkage metals, it is advisable in the case of aluminum bronzes to make the risers much higher than usual in order to provide for an effective head of metal and to counteract the combined influence of shrinkage and foaming. The metal in the mold must be supplied with hot metal under high static pressure until the entire center of the casting has solidified. The risers should be placed above the heavy sections of the castings and in position calculated to draw all dross and impurities into them. In molding castings of strongly varying cross sections, it is advisable to provide chills in suitable positions near the heavier sections. Where this proves to be impossible or inadvisable, preferential cooling of these sections must be effected by removing the molding sand from these portions as soon as the metal has sufficiently solidified. This exposure must not be carried out too early, however, for even if bleeding of the casting is not very likely if the sand is removed carefully, the intercourse of liquid metal within the casting may possibly be interrupted, which would lead to the formation of porosities and blowholes in the neighborhood of the heavy sections.

Pouring of these aluminum bronzes is not nearly as difficult as is commonly believed, and many casting troubles encountered in connection with these alloys are due to faulty molding rather than to incorrect pouring, to which they are frequently ascribed. The pouring properties of aluminum bronzes are indeed greatly benefited by the fact that the metal remains quite fluid down almost to its temperature of solidification. The comparatively low pouring temperatures of these metals can therefore be maintained without trouble, and pronounced liquation, or segregation phenomena are impossible even in large and heavy castings.

A great deal of attention must however be paid to the cleaning of the metal surface in the ladle, or crucible, and to the protection of the metal against atmospheric oxidation during the pouring process. It is not advisable for this reason to skim the surface of the metal in the ladle free from slag but to leave the slag on and prevent its flowing over with the metal by means of skimmers held directly in front of the snout. Where the slag mixtures employed are too thin for this purpose they are to be thickened by means of a handful of sand or fireclay. The snout of the ladle must be placed as near to the mouth of the sprue as possible and the metal poured over in a steady and uniform stream. The sump must be maintained full at all times. Pyrometers must be employed to ensure correct pouring temperature, and temperatures found satisfactory for a certain purpose must be maintained implicitly.

It is necessary in casting large and medium pieces to work with two metal temperatures, the bulk of the metal being cast at the normal standard temperature tried out for this purpose, while the pouring temperature of a special crucible full of metal should be maintained at a temperature about 150 degrees hotter than the standard temperature. The hot metal is used for filling up the risers after the bulk of the metal has been poured through the sprue. It flows into and through the semi-solidified casting, filling up shrinkage cavities and pores and supplying the metal reserve required for replenishing shrinkage space. This method is very effective in combating the tendency of these alloys to form pores and blowholes, particularly in view of the fact that they exhibit a very narrow range of solidification, so that the solidification of one part of the casting is rapidly followed by the remainder, leaving little time for fluid metal to reach all the hollow spaces induced by the high degree of shrinkage.

A very serious mistake frequently committed by foundries in pouring these aluminum bronzes is the following. As a rule, a standard ladle or pouring crucible is used in casting all types of metals into any type and size of mold, and small molds are usually filled from the same ladles which serve for molds 10 or 15 times as large. It is obvious, therefore, that if, say, 20 molds are filled from 1 ladle, the actual pouring temperature of the first and last casting of a set differ by as much as 30 to 50 degrees. It is equally obvious that for reasons outlined above such a difference is entirely too high for alloys of this type, even if the original pouring temperature is selected so that the middle castings of the set are poured at the correct pouring temperature. It is necessary therefore to adapt the size of the ladles to that of the castings, or where suitable ladles are not available, to pour with two ladles interchangeably, placing the one into a reheating furnace after a certain number of molds have been filled and continuing pouring with the other ladle. Experience with castings of this type has shown, however, that small castings should be poured from the melting crucibles directly in order to avoid unnecessary fluctuations of temperature.

Removal of Carbonates from Metal Cyanide Solutions

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The Best Conditions and Temperatures for Removing Carbonates by "Freezing Out."

Building Up of Carbonates

THE tendency today is to operate electroplating solutions at higher current densities. This has been possible with the acid type of solution but the formation of carbonate of soda through the decomposition of sodium cyanide by electrolysis has limited the permissible current density of the metal cyanide solutions. Heat has been applied to nickel solutions to permit high current density with good results. If heat is applied to solutions containing sodium cyanide the rate of the formation of sodium carbonate is increased. The presence of a carbonate in metal cyanide plating solutions is necessary up to a certain point but beyond that content the cyanide decomposes more rapidly and the cathode efficiency decreases due to the increase in gassing. This increase of gassing at the cathode, and consequent decomposition of cyanide, makes it necessary to add sodium cyanide more frequently. This makes a vicious circle as the more cyanide added to the solution, the more rapid the formation of carbonates, the necessity for more often additions of cyanide, and consequently the carbonates are on a constant increase.

It is known that many platers state that carbonates do not build up in their solution. This no doubt is due to the low current density used and to the amount of drag-out which is often greater than realized. If metal cyanide plating solutions are run above 110 degrees F., and with a high current density carbonates will increase. The exact content of carbonates that is detrimental to each type of metal cyanide solution has not been determined. It is recognized that the cathode efficiency of both a brass and a copper solution materially decreases when the carbonate content as $Na_2CO_3 \cdot 10H_2O$ is above 12 oz. per gallon. It is also known that the titration of the free cyanide with silver nitrate is affected by the presence of carbonates especially in a brass solution. From the results of this investigation it is predicted that the changing point of cathode efficiency starts when the sodium carbonate content is between 8 oz. and 10 oz. per gallon.

Removal of Carbonates

Some simple and efficient method of the removal of excess carbonates will increase the life of a metal cyanide plating solution. The addition of barium cyanide has been advocated. This method is neither economical nor efficient. If the free cyanide of the solution is at the correct point the addition of barium cyanide which forms barium carbonate, (an insoluble salt) and sodium cyanide, will increase the free cyanide beyond the desired content. A deficiency of free cyanide can be made up by adding barium cyanide but first this deficiency must be determined and the amount of barium cyanide permissible must be calculated. This amount in most cases will be found to be very small. The insoluble barium carbonate cannot be filtered out after each small addition of barium cyanide, and as it is a light material the probability of its being suspended in the solution every time work is removed is quite evident and will cause rough deposits. The addition of sufficient barium cyanide to remove only a few ounces of sodium carbonate will, as stated, increase the free cyanide beyond the permissible content. The cost of this method is considerable as it will be found the free sodium cyanide manufactured in the plating solution by the addition of barium cyanide is many times that of commercial sodium cyanide.

Several years ago,* through accident, it was found that sodium carbonate crystals will form if the temperature of the solution is reduced. It was then predicted that at a temperature of 26 degrees F. the carbonate content of a silver solution could be reduced without the loss of sodium or of metal cyanide. While this method has been followed and often referred to in the literature no one has investigated the process to determine just what happened and at what temperature the optimum results can be obtained. This is a good time of the year for most platers to treat their solutions if the carbonate content is high and therefore the results of this investigation should be of interest.

Experimental Work on Removal of Carbonates by "Freezing Out"

Brass, copper, silver, and zinc cyanide plating solutions were prepared having the following compositions:

Brass:	Copper cyanide	3.6 oz./gal.
	Zinc cyanide	1.2 oz./gal.
	Sodium cyanide	7.5 oz./gal.
	Soda ash	24.0 oz./gal.
Copper:	Copper cyanide	3.0 oz./gal.
	Sodium cyanide	4.5 oz./gal.
	Soda ash	24.0 oz./gal.
Silver:	Silver cyanide	3.5 oz./gal.
	Sodium cyanide	3.5 oz./gal.
	Soda ash	24.0 oz./gal.

* The Metal Industry, Vol. 12, No. 1, 1914, pp. 4-5. "Carbonates In Silver Solution".—George B. Hogaboom.

Zinc:	Zinc cyanide	8.0 oz./gal.
	Sodium cyanide	3.0 oz./gal.
	Caustic soda	7.0 oz./gal.
	Soda ash	24.0 oz./gal.

These are standard plating solutions except for the addition of a larger amount of carbonates as soda ash or anhydrous sodium carbonate. The solutions were placed in glass quart jars, a small hole was punched in each cover and a glass stirring rod inserted. The jars were immersed in a water bath, electrically heated and thermostatically controlled at 126-127 deg. F. They were held at this temperature until all the carbonates were dissolved.

The temperature was reduced to 90-91 deg. F. A few grains of pumice stone were added to minimize supersaturation and the solutions were held at this temperature for 24 hours. No precipitation occurred. The temperature was reduced to 75 deg. F. and then to 47 deg. F. The solutions were held at each of these temperatures for 24 hours. There was some precipitate in all the solutions but the zinc. On stirring the latter solution was found to be supersaturated in spite of the precautions like occasional stirring and the presence of the grains of pumice. A large amount of precipitate formed with a rise in temperature of about 9 deg. F. Since the temperature is lowered when sodium carbonate goes into solution, this phenomenon is to be expected. This temperature was maintained for another 48 hours and the solutions were analyzed for carbonates by precipitating with barium nitrate solution and titrated. The filtrates were tested for carbonates and the precipitates were washed completely as indicated by the absence of barium ions in the wash water.

The results of the analyses indicated that the precipitation of the carbonates in the case of the zinc solution differed from the others in that the carbonates in solution at this temperature was little more than half of that in the other three solutions which agreed closely. Further investigation revealed the existence of one of the heptahydrates, $Na_2CO_3 \cdot 7H_2O$ which is about twice as soluble at 50 deg. F. as the decahydrate, $Na_2CO_3 \cdot 10H_2O$, which is ordinarily precipitated from supersaturated solutions at low temperatures (Comey —Dictionary of Chemical Solubilities, p. 92, 1896). The higher solubility of the carbonates in the brass, copper, and silver solutions may therefore be due to the presence of the heptahydrate.

The jars containing the plating solutions were immersed in a bath of chipped ice and placed in an electric refrigerator for 24 hours and then analyzed. The results are tabulated in Table 1. These temperatures were maintained constant. The completeness of precipitation was checked by allowing the solutions to stand at the same temperature for another 24 hours after which time they were again analyzed for carbonates. The results indicate that precipitation is practically complete at the end of 24 hours.

TABLE 1—SOLUBILITY OF SODIUM CARBONATE

(Na_2CO_3)-Oz./Gal.

TEMP.	Brass		Copper		Silver		Zinc	
Deg. F.	24 oz.	36 oz.	24 oz.	36 oz.	24 oz.	36 oz.	24 oz.	36 oz.
100°	...	25.6	...	24.4	...	24.0	...	...
70°	...	24.2	...	23.0	...	23.0	...	35.4
47°	16.9	...	17.1	...	17.2	...	10.1	...
34°[1]	12.1	...	12.0	...	11.6	...	8.3	...
34°[2]	11.6	...	11.9	...	11.6	...	8.4	...
28°	...	10.8	...	...	...	10.3	...	...
27°	...	...	...	9.8	...	...	...	...
26°	...	...	...	...	...	...	...	8.3
25°	9.7	...	9.7	...	8.9	...	8.5	...

1—After 24 hours crystallization.
2—After 48 hours crystallization.

In order to establish a solubility value at a higher temperature and to determine whether the starting concentration affected the results, another series of determinations were made in the same manner as above, except that the solutions contained 36 oz. of sodium carbonate per gallon instead of 24 oz. The same effect of supersaturation was revealed in the case of the zinc solution. The results of these experiments (Table 1) show that the minimum concentration of carbonates is not affected by the original concentration, which is to be expected.

The temperature of solutions was held at 25 deg. F. for 24 hours and the carbonates in solution were determined. This temperature was lowered until ice began to form and float on the surface of the solution. The freezing temperature was found to be about 23 deg. F. and indicated that in the removal of carbonates, 25 deg. F. is the lowest temperature practicable. The minimum amount of carbonates which remains in solution is between 9 and 10 oz./gallon, which may be found to be the maximum content for efficient operation of a metal cyanide solution.

Occlusion of Other Salts in the Carbonate Precipitate

The next experiment was for the purpose of determining whether there was any occlusion of other salts in the carbonate precipitates. The carbonates were filtered and washed with cold water. They were then dissolved in water and tested for metal content qualitatively. In the case of the precipitates from the brass, silver, and zinc solutions the redissolved carbonate solutions were heated and sodium sulfide solution was added. The absence of more than a trace of brown silver sulfide or white zinc sulfide precipitate proved the absence of any occlusion of salts. In the case of the carbonates from the copper solution, the precipitate was dissolved, neutralized with sulfuric acid, and boiled after adding a few drops of nitric acid. The solution was then cooled, neutralized with ammonia and a slight excess of ammonia was added. The absence of the deep blue coloration which is due to the copper-ammonia complex showed the absence of metal.

It has been assumed that the sodium carbonate crystals removed what may be termed the "free water" from the plating solution and that if after the removal of the precipitated carbonates more water is added a second "freezing" would remove more carbonates. This was not found to be the case even if the solution was maintained at 25 deg. F. for 72 hours.

It is interesting to note that at both concentrations used, at 25 deg. F., the amount of sodium carbonate left is practically the same in all the solutions investigated. From the data assembled (Table 1 and the curves for the four solutions investigated—see p. 66) it appears that there is a precipitation of carbonates at higher temperatures than expected when the concentration of carbonates is permitted to go above 10 oz. per gallon. It may be that the character of the deposited metal is materially affected by this and that some of the troubles assigned arbitrarily to other causes are due to the high sodium carbonate content of the solution. This should make an interesting study

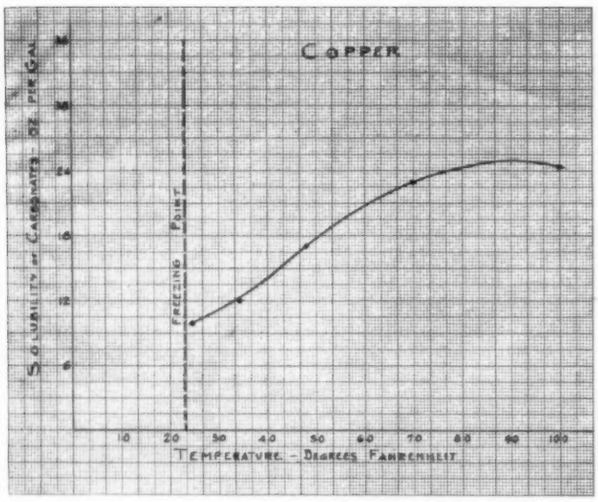

Fig. 1. Amount of Sodium Carbonate Held in Copper Cyanide Plating Solutions at Various Temperatures

and it is predicted that coarsely crystalline and porous deposits will be found. It is of importance to know this if a minimum thickness of deposit is to be specified for a definite period of protection; or, some of the recent accelerated test methods are to be adopted. The zinc curves are especially significant.

Conclusions

1. The lowest temperature practicable for removing sodium carbonate by "freezing" is about 25 deg. F.
2. All sodium carbonates in excess of 8.5 to 10 oz./gal. may be removed by "freezing." In connection with this it should be noted that each pound of sodium

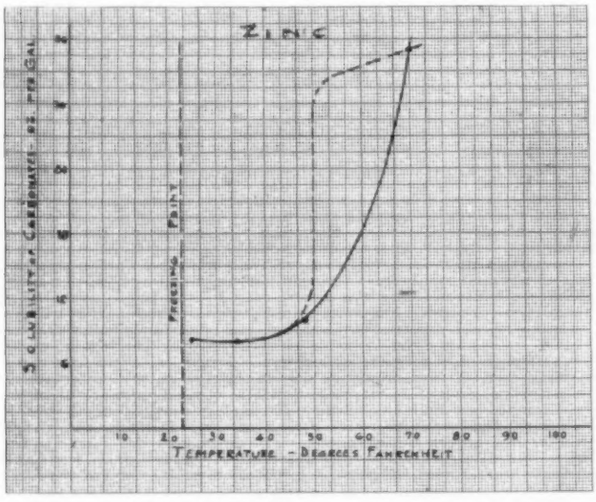

Fig. 2. Amount of Sodium Carbonate Held in Zinc Cyanide Plating Solutions at Various Temperatures

carbonate which precipitates as the decahydrate removes 1.7 lbs. of water as water of crystallization. The solution remaining after freezing contains 8.5 to 10 oz. per gal. of carbonates but on adding water to the original volume, the concentration becomes less, the value depending on the amount of water which is added This suggests the paradoxical method of removing carbonates by adding more carbonates since, if the anhydrous soda ash is added and the hydrated sodium carbonate is removed, the volume of the solution remaining is decreased. Thus, if we have a 100 gal. solution containing 20 oz./gal. of carbonate and lower the carbonates to 10 oz./gal. by freezing, we have removed 106 lbs. or about 13 gallons of water. If we were to add 10 oz./gal. of soda ash before freezing and we ended with the same final concentrations, we would have removed about 26 gallons of water so that neglecting the volume of the soda ash we are left with 87 gallons in the first case and 74 gallons in the second case. Upon dilution to 100 gal. the final

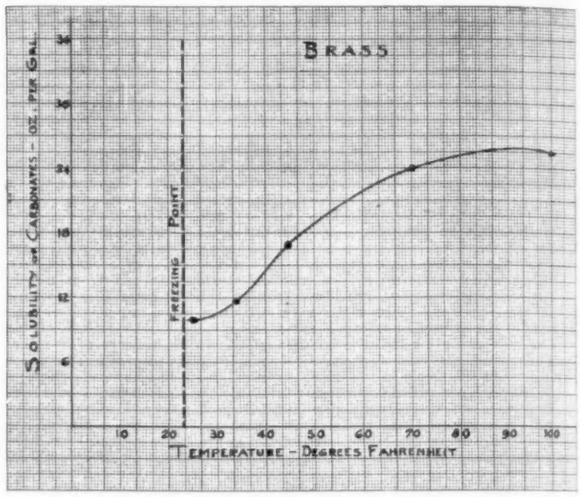

Fig. 3. Amount of Sodium Carbonate Held in Brass Plating Solutions at Various Temperatures

concentration becomes 8.7 oz./gal. and 7.4 oz./gal. respectively

3. If the solution is concentrated before freezing out the sodium carbonate, the concentration in the plating solution may be reduced below 8½ to 10 oz./gal.
4. If the sodium carbonate precipitates are drained well, the loss of metal cyanides will be very small.
5. The minimum sodium carbonate content does not depend on the starting carbonate concentration.
6. Adding water to the solution and refreezing does not remove more carbonates.
7. Not more than 24 hours are necessary for complete precipitation.

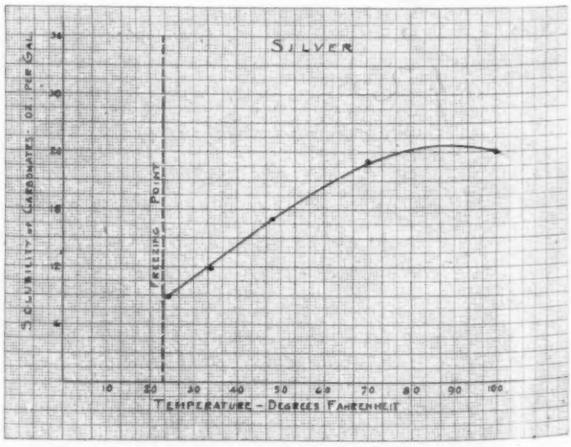

Fig. 4. Amount of Sodium Carbonate Held in Silver Cyanide Plating Solutions at Various Temperatures

The Application of Lacquer by Tumbling

By CHARLES W. HARDY
Industrial Consultant,
New York.

A Time, Labor and Material Saving Method of Coating Small Metal Objects.

THERE are various kinds of small metal and wooden parts which can be very satisfactorily lacquered by the tumbling method, that are in many plants still being placed on screens or special, expensive racks and sprayed or dipped.

To be specific in the metal industry: buckles, shoe, dress and millinery; buttons; eyelets, ferrules; hardware; ornaments, dress, millinery and bag frame; snap fasteners; springs, toys, etc.; a variety of wire formed parts; screw machine products; sheet metal stamped parts; eyelet machine products; heading machine work; etc. In general, articles that are cupped, domed or irregular shapes and contours and those parts with delicate threads, etc. can and are being tumbled lacquered.

Equipment Required

In some plants the equipment is available. All that is necessary is a few slight changes. If not, the cost to purchase or construct it is low.

Any small iron tumbling barrel oblique tilting type, will serve the purpose nicely. If the inside is smooth and there are no baffle plates or bars you will have to attach by riveting, soldering or welding four ¼" x ½" rectangular iron bars cut to the necessary length; should be evenly spaced.

The most important factor is that of speed and there are many different opinions as to the right rate of rotation. But the writer has learned by considerable experimenting that in many cases a range of 10 to 25 R.P.M. is practical and produces satisfactory results. For parts with delicate threads use the slowest possible speed

If you decide to construct, use any standard size crock, can, drum, container, etc. of appropriate size for your purpose, for the barrel. Make a revolving base for the barrel to set into. Power can be from a line shaft or by a small motor with the right ratio gear reduction unit.

Use a round mesh basket to fit inside the barrel held by four upright supports that hook onto the top of the barrel and that will allow from ½" to 1" space at bottom (see Fig. 1).

The basket can be removed for filling or emptying. If accelerated heating is desired for drying the work, it can be left in the basket or can be transferred to a wire screen and placed in the heating unit.

Some of the advantages of the basket are:—

1. In case too much lacquer is applied it allows the surplus to flow to the bottom of the barrel.
2. Not necessary to put baffles in barrel, the mesh "breaks-up" the mass.
3. The small amount of time involved in handling.
4. Steel burnishing balls, sawdust, etc. will separate from the work.

Caution: if the barrel and basket are made from brass or similar alloys be sure to have them heavily tin or lead coated.

Application of Lacquer & Thinner

Be sure the work is dry and clean; also as free from sawdust as you can get it.

For applying the mixed lacquer and thinner to the work in the basket use a can mounted directly over the barrel with its faucet at the extreme top of the tilted barrel. Allow for inserting and removing basket readily. A can for this purpose (with cover) can be purchased ready to use from manufacturers of spray equipment, the same as is used for gravity feed when using spray gun.

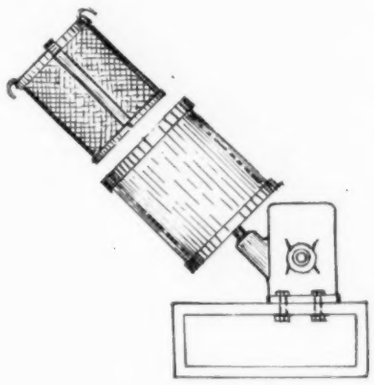

Fig. 1. Tilting Type Barrel with Wire Mesh Basket

For the mixture of lacquer and thinner ask the supplier the best proportion for tumbling; generally 50% mixture. Fill the gravity feed can and allow a very small quantity to drip on the work in the basket. You will be amazed at the small quantity required.

The exact quantity needed is a guess, but it is surprising how expert an operator can become in allowing just enough to give a good coverage. A good check is to put a hand in the work and feel if parts are sticky (all lacquered).

Correction

In our January issue on page 30 we published an illustration of a drying room for polishing wheels. We neglected to give proper credit for the use of this cut. Acknowledgment is herewith made to the Norton Co., Worcester, Mass.

The Testing of Thickness of Deposits

The B.N.F. Jet Test for Nickel and Other Coatings. A New Method of Determining Thickness in a Few Minutes with Simple Equipment*.

By Dr. S. G. CLARKE

METALLIC coatings depend largely for their protective value on adequate thickness of the metal layer, but, owing to unequal distribution of coating in the plating process or losses in polishing some portions of the deposit may be thinner than is desired, even if the average thickness over the whole surface is sufficient. In recent discussions on specifications, stress has been laid on requirements for minimum thickness on areas described as significant surfaces. For purposes of inspection and control of local thickness, an alternative to direct microscopic measurement of a prepared section was desired as this method is lengthy, except with a specially organized technique[1], and requires considerable skill and expensive equipment. The dropping method, which was proposed in 1933[2] but has so far only been applied to cadmium on steel[2,3], and zinc on steel[3], offered advantages over the usual laboratory methods as it permitted thickness to be rapidly measured at selected points, and the apparatus is inexpensive and portable. The principle consisted in allowing drops of a corroding solution to fall steadily on the surface, thus exposing it continuously to the solvent action of fresh solution, causing penetration at a uniform rate. At the point of perforation when the basis metal is first exposed, the number of drops or alternatively, the time taken, gives a measure of the thickness of coating.

This method has now been modified and extended to make it applicable to electrodeposited nickel, copper and bronze, as well as zinc and cadmium coatings. In the modified test, a stream of reagent from a small jet is allowed to impinge on the surface in place of successive drops. The necessity for regulating rate of dropping is thus avoided, and improved definition at the point of perforation is secured. The rate of perforation is greater by a stream than with drops, a factor which is of some practical importance in dealing with a resistant metal like nickel. The flow of liquid is interrupted from time to time for inspection of the surface, or, alternatively, the solution is run continuously for a time equivalent to the specified thickness. Coatings of commercial thickness require 1 to 2 minutes for perforation. The accuracy should be within 15 per cent. The test is non-destructive to the basis article, which may be stripped and replated.

Description of Jet-Test†

The apparatus (Fig. 1), consists of a tap-funnel of about 100 ml. capacity, having a burette jet sealed on to the stem. The size of the orifice of the burette jet, while not critical, should preferably be such that the jet will deliver 10 ml. of water in 30 seconds with the apparatus assembled. The reservoir bottle has an exit tube ½ in. in diameter fixed into its neck by a rubber stopper. The dish to receive spent solution should be provided with a gauze lid to prevent splashing. In assembling the apparatus, the filled reservoir bottle is inverted into the tap funnel and clamped with the exit tube just reaching to a graduation mark made on the side of the funnel at a distance of 10 inches from the tip of the jet. This provides a "constant-head" supply. It is preferable to fill up the bore of the tube between the taps, and for this purpose the provision of a side tube as shown is advantageous, as its rubber stopper can be manipulated to expel air, the upper tap being open. The lower tap is not essential, and in an apparatus constructed without it the side-tube could also be omitted. In use, the bottom tap is kept permanently open, stopping and starting the flow being done exclusively with the top tap. A thermometer is inserted in the liquid in the funnel. A "stop-and-go" type of stop-watch or clock is used to time the flow of liquid.

Preparation of Surface for Testing

The surface to be tested must be free from grease and chromium coating. Chromium can be readily dissolved off in hydrochloric acid containing some

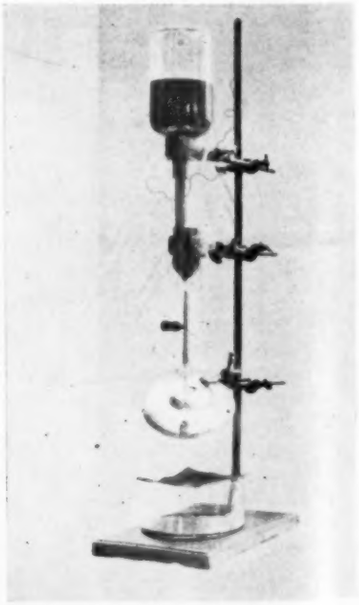

Fig. 1. Apparatus for Jet Test

* Abstract of a Paper read before the Electrodepositors' Technical Society, London, England, October, 1936.
† Provisional patent application No. 16569/36; British.

dissolved antimony oxide (2 per cent concentration is suitable) to accelerate the solution process and prevent attack on the underlying nickel or steel; copper or copper alloys do not suffer appreciable attack if withdrawn from the acid promptly after removal of chromium; the black deposit of antimony is then swabbed off with water. For degreasing, it is effective to rub the surface with a damp swab of cloth or cotton wool sprinkled with finely powdered magnesium oxide, which is then washed off with water. The article is then dried by means of greaseless absorbent paper or cloth or rinsed with acetone and dried in the air.

Testing

The apparatus having been filled with the appropriate solution, the article is securely clamped with the surface about ¼ in. beneath the jet and at an angle of about 45° to the horizontal. The stream of liquid and the stop-watch are started simultaneously, allowed to proceed for 5 to 10 seconds, then stopped, and the spot examined (see Note 1). This process is repeated without moving the test-piece until the first sign of penetration is seen immediately below the jet. (A summary of the end-point effects with different coatings and basis metals is given in Tables I, II and III). The time required for penetration of 0.0001 in. of the coating at the temperature of testing is read from the appropriate curve (Fig. 2 or 3), whence the thickness of coating tested can be found

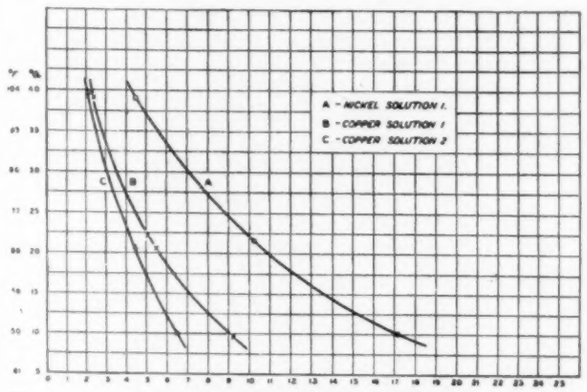

Fig. 2. Seconds for Penetration of 0.0001 Inch—Nickel and Copper Solutions

by simple proportion from the time taken in the test. Example: Nickel coating; found 45 seconds at 21° C.; from curve 10.5 seconds required for 0.0001 in.; thickness measured = 45/10.5 = 0.00043 in.

Specification Test—For testing whether a coating is of a stated minimum thickness the solution can be run for a period equivalent to that thickness (Fig. 2 or 3) and the spot examined for perforation. This procedure is not suitable for composite coatings made up of metals which dissolve at different rates.

Notes—(1) The end-point cannot be readily seen while the liquid is running on the surface. If the thickness is approximately known, the solution can be run without interruption for a time nearly equivalent to the thickness. The test should be finished with short periods of flow (say 2 seconds) to enable the total period for penetration to be accurately timed.

(2) The timing instrument used should be of the "stop-and-go" type, as it is required to add up the separate intervals of time during which the solution is flowing. An Eastman Timer (portable dark-room clock) is suitable and inexpensive. A "fly-back" stop-watch is unsuitable except for the specification test.

(3) The apparatus and test-piece must be firmly clamped to prevent any relative movement between jet and specimen. In order to minimize vibration, the upper tap should be used in stopping and starting the flow of solution.

(4) The process would appear to be applicable to surfaces of widely varying size and shape, for example, thin rods, the main restriction being that there must be a free "run-off" for the solution; the specimen should be mounted in such a position that solution does not collect on the spot being tested. In testing near an edge, for example, the edge should be kept uppermost, so that solution drains away from it.

Solutions

Appropriate corroding solutions were selected by trial. For nickel coatings, a solution (Solution I) containing ferric chloride, copper sulphate and acetic acid was adopted. Ferric chloride is the principal solvent constituent. The dissolved copper, while not forming a replacement deposit on nickel, produces a coppered spot on certain basis metals at the point of perforation within a few seconds after the flow has stopped, this time being required in order to allow excess of solution, in which metallic copper is soluble, to drain away. The acetic acid prevents attack being localized at pores in nickel coatings on anodic basis metals like steel, and thus has a marked effect in sharpening the end-point. This solution is

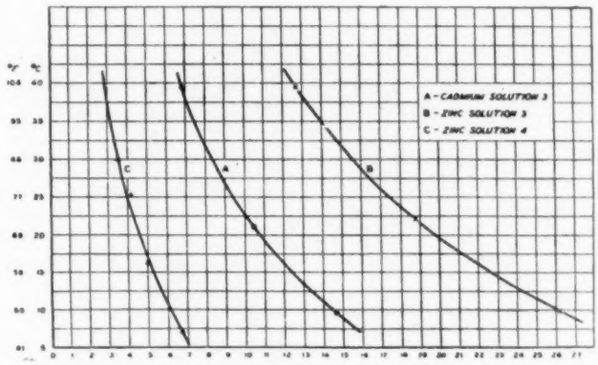

Fig. 3. Seconds for Penetration of 0.0001 Inch—Cadmium and Zinc Solutions

also useful for copper coatings on various metals, but in the case of copper on steel, the replacement deposit of copper formed when the steel is exposed has the same color as the surrounding copper; a "spotting-on" indicator, consisting of a solution of antimony chloride, which blackens the re-deposited copper without affecting the copper coating, may be used for detecting the end-point. An alternative corroding solution (Solution II), containing the antimony indicator, was adopted for the direct testing of copper and bronze on steel. For cadmium and zinc, ammonium nitrate solution acidified with hydrochloric acid was employed; the solution is similar to that used in the dropping test[3], but is less concentrated in view of the more rapid rate of attack in the jet-test. The same strength of solution (Solution III) may be used for both cadmium and zinc, but as zinc dissolves more slowly than cadmium, it was found convenient to use a stronger solution (Solution IV) for zinc. The above mentioned solutions of suitable strength are standardized by determining the time of flow required for perforation of a unit thickness of coating.

Application of Method—1. Single Coatings

NICKEL COATINGS (ON STEEL, COPPER, BRASS, ALUMINUM, ZINC ALLOYS)

SOLUTION I

(Fig. 2 shows rate of penetration).

Ferric chloride	100 grams per litre
Copper sulphate crystals	150 grams per litre
Glacial acetic acid	250 ml. per litre

The ferric chloride to be used is the hydrated material known as iron perchloride ($FeCl_3$ $6H_2O$); it should be of good quality and taken from a tightly-stopped container (see Table IV). The solution is best prepared by dissolving the ferric chloride and copper sulphate in about half the required amount of water, then adding the acetic acid and diluting to volume in a graduated flask. The solution requires filtering, as there is generally some residue from the ferric chloride. End-point effects with different basis metals are shown in Table I.

TABLE I. END-POINT DETECTION—NICKEL COATINGS

Basis Metal.	Effect at End-point.
Steel	Coppered spot due to replacement deposit of copper; spot not formed until few seconds after flow stopped because copper is soluble in excess of solution.
Copper	Copper spot.
Brass	Brownish-yellow spot; the basis brass is somewhat discolored.
Aluminum	Black spot.
Zinc base die-casting	Black spot.

Nickel coatings deposited from the usual plating solutions are somewhat discolored by the solution, but no coppering occurs prior to perforation, except with very thin porous coatings.

Note on "Bright Nickel" Coatings—One type of bright nickel deposit (deposited from baths containing sulphonic acids as brightening agents, **e.g.**, the Schlotter bath*) yields abnormal results in the test. This material can be recognized by the formation of a localized dark or black spot where the jet impinges, and in extreme cases this dark colored material requires to be rubbed off with the tip of a small roll of paper or cropped camel-hair brush before the perforation point can be distinguished. This type of deposit dissolves more rapidly than ordinary nickel, so that the apparent thickness as found with the aid of the curve (Fig. 2) requires to be increased by a factor of 1.8. Another type of bright nickel deposit (prepared from the Weisberg and Stoddard bath†, containing formate, formaldehyde and cobalt brightening agents) gives a general darkening by the solution, but the rate of attack is normal.

TABLE II. END-POINT DETECTION. COPPER COATINGS. (SOLUTION I)

Basis Metal	Effect at End-point.
Nickel	White spot.
Aluminum	Black spot.
Zinc Alloy	Black spot.
Steel**	Replacement deposit of copper which resembles the surrounding copper coating and masks the end-point.††

*U. S. P. 1,972,693.
†U. S. P. 2,026,718.
**Method (B) (below) is preferable.
††The replacement deposit of copper may be revealed by placing on the spot a drop of 1 per cent solution of antimony oxide in 1 : 1 hydrochloric acid (from a fountain pen filler or pipette); this blackens the spot leaving the surrounding copper almost unaffected.

Copper Coatings

(A) On Nickel, Aluminum, Zinc Alloys—Solution I, as recommended for nickel coatings is used. Fig. 2 shows the rate of penetration. End-point effects are shown in Table II. The solution darkens the copper somewhat; copper deposits from cyanide solution being more affected than deposits from sulphate solution.

(B) On Steel, Nickel—Solution II is used. End-point effects are shown in Table III.

SOLUTION II

(Fig. 2 shows rate of penetration.)

Ferric chloride ($FeCl_3$ $6H_2O$)	150 grams per litre
Antimony oxide (Sb_2O_3)	20 grams per litre
Hydrochloric acid (sp. gr. 1.16)	200 ml. per litre
Glacial acetic acid	250 ml. per litre

TABLE III. END POINT DETECTION. COPPER COATINGS SOLUTION II

Basis Metal	Effect at End-point.
Steel	Black spot***
Nickel	White spot

*** Produced by interaction of antimony in solution with the replacement deposit of copper.

Bronze Coatings

With the use of Solution II, the rate of penetration and the end-point detection are the same for practical purposes as for copper. This applies to electrodeposited bronze containing up to about 15 per cent of tin. Bronze with higher tin content has not been investigated

Cadmium Coatings

Solution III is used; the end-point is shown by contrast in appearance between cadmium and exposed steel.

SOLUTION III. (FIG. 3 SHOWS RATE OF PENETRATION.)

Ammonium nitrate	17.5 grams per litre
Hydrochloric acid (normal)	17.5 grams per litre
or	
Hydrochloric acid (sp. gr. 1.16)	2.0 grams per litre

Zinc Coatings (On Steel)

Solution IV is preferred; the end-point is as for cadmium.

SOLUTION IV. (FIG. 3 SHOWS RATE OF PENETRATION.)

Ammonium nitrate	70 grams per litre
Hydrochloric acid (normal)	70 ml. per litre
or	
Hydrochloric acid (sp. gr. 1.6)	8.1 ml. per litre

Composite Coatings

The following representative examples have been tried. In the course of penetration of the composite coating the sequence of effects noted below could be detected. The rate of solution appropriate to the metal is employed in calculating thickness:—

Nickel-Copper-Nickel on Steel. (Solution I)

(1) Top nickel coating: Copper spot at perforation; copper spot broadens out as coating dissolved away.

(2) Middle copper coating: White nickel spot at perforation; nickel spot broadens out as copper coating dissolved away.

(3) Bottom nickel coating: Copper spot at perforation due to coppering of exposed steel; short periods of running of solution should be used to facilitate detection of this point.

Nickel on Copper on Steel (Solution I)

(1) Top nickel coating: Copper spot at perforation.

(2) Bottom copper coating: Perforation detected by applying periodically a drop of antimony hydrochloric acid solution as in Method A for copper on steel.

Nickel on Copper on Zinc-Base Die-Casting
(Solution I)

(1) Top nickel coating: Copper spot at perforation.

(2) Bottom copper coating: Black spot at perforation.

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[1] C. E. Heussner, The Monthly Review, American Electroplaters' Soc., 1936. **23**, 5.

[2] S. G. Clarke. J. Electrodepositors' Tech. Soc., 1933, **8**, 11.

[3] R. O. Hull and P. W. C. Strausser, The Monthly Review, American Electroplaters' Soc., 1935, **22**, 9.

[4] S. G. Clarke, Trans. Electrochem. Soc., 1936, **69**, preprint 18.

Corrosion Test of Wire

A. S. T. M. Atmospheric Corrosion Tests on Wire and Wire Products Are Under Way. Eleven Thousand Test Specimens in Country-Wide Test Program.

IN THE country-wide series of atmospheric corrosion tests of wire and wire products, being carried out by the American Society for Testing Materials, with its Committee A-5 on Corrosion of Iron and Steel in direct charge of the work, there are almost eleven thousand (10,886 to be exact) test specimens involved. There are involved in the tests about six miles of plain wire, over a mile of barbed wire, about one half mile of strand, about two miles of farm fence and one-third mile of chain-link fence.

This vast research program has two major objectives: (1) to obtain essential engineering information concerning the materials involved and (2) to assist in establishing national standard specifications for fencing, barbed wire and the other products which will afford consumers an adequate guide in purchasing the materials.

In the absence of adequate artificial or accelerated tests for examining metallic coatings for merit in service, a knowledge of the field performance of metals and metallic coatings is of the greatest importance to the prospective user and the data from actual field tests are the only source of reliable information on which to base the requirements of specifications. With the facts known and property interpreted, it will be possible to record the knowledge in the usable form of standard specifications thus facilitating the economic procurement of metallic-coated products of various types to meet various conditions. Committee A-5 has therefore planned a study of metallic coatings—principally of zinc but including also cadmium, aluminum, lead and copper—on (1) iron and steel sheets, (2) shapes, hardware, and tubular goods, and (3) wire and wire products exposed to different types of atmosphere. The first two parts of the investigation were started respectively in 1925 and 1929, the third part is now beginning.

Full information on this testing program is obtainable from the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

Permanent Molds

Q.—What metals are used for permanent molds for casting white metals, aluminum, brass etc.?

A.—By permanent molds it is assumed that you mean molds for gravity casting rather than pressure die casting. Aluminum alloys are extensively cast by gravity in cast iron molds, preferably high-test iron or semi steel. An article on page 50 of the Nov. 5th, 1936, issue of Iron Age describes this process in detail. Other white metals may be cast in iron or steel molds but at present the method has little commercial importance. The casting of brass in iron molds has been thoroughly discussed by Henri Marius in a paper presented to the American Foundrymen's Association at its Chicago meeting in May 1931. In this case the process was applied particularly to leaded bronze bearings and bushings for railroad work. The molds were not expensive and had a useful life of nearly 4,000 casts. The castings were fine grained and free from lead segregation. An article by the same author in the Aug. 15th, 1929, issue of Foundry, page 682, gives additional information.

—H. M. St. John.

Reclaiming Terne Plate Scrap

Q.—I have a quantity of terne plate scrap. How can I dispose of it or reclaim the lead and tin?

A.—Terne plate scrap can be used by iron foundries, as a small constituent of the charge, in castings which will not suffer from the presence of a little lead and tin, sash weights for example. It is barely possible that a small manufacturer of washers and shims might use the material to advantage but no large-scale stamping concern could do so economically. We would not like to venture an estimate of market value; it is worth whatever you can get for it.

—H. M. St. John.

Editorial Comment

Help for Metal Manufacturers

THE manufacture of metal products calls for such a variety of raw materials and compounded products from the original casting or stamping to the finished article that the average manufacturer very often, if not always, finds himself in a serious quandary. In order to understand thoroughly every process that goes into the making of his job, he must be a metallurgist, an inorganic chemist, an organic chemist, a mechanical engineer and an electrical engineer, to say nothing of the selling, advertising, purchasing and collecting work with which he must be familiar. Obviously the range of knowledge required is too much for any single individual. How then is he to exercise the necessary control over his production?

A paper in the January issue of The Monthly Review of the American Electro-Platers' Society gives the soundest possible advice on this problem. Dr. Gustav Klinkenstein, writing on "Fitting the Lacquer to the Job," makes the following pertinent statements:

1. There is no one best lacquer for all jobs.
2. Be sure to choose the lacquer that was developed for the metal upon which it is to be applied and to withstand the conditions under which the product is to be used.
3. Consult the lacquer manufacturer; ask him to work with you, to advise on the finishing problem. Consult him before starting to turn out a new product and inform him of every change in your manufacturing process or the use of your products. Summon him whenever trouble arises.

The advice given above can be applied not only to lacquers but to almost every type of equipment or supply used by the metal products manufacturer. The seller of supplies is not only a salesman or a dealer turning over a commodity at a profit, but also a guide and adviser to his customer. In order to fulfill his function properly he must feel it to his interest that his customers' products be durable, attractive and satisfactory to the consumer. If he is progressive and wide-awake he will work to that end.

Let the supply man help the manufacturer.

Silver in Industry

THE publication of the Annual Review of the Silver Market by Handy and Harman, brings directly to our attention this most important precious metal which has for some time been the football, not only of speculation, but also of politics. The Silver Purchase Act has always been hard to explain on economic grounds. It is the opinion of Handy & Harman that while some justification may be found for its passage on the ground that it provided a means of inflation and satisfied a popular demand in Congress at that time, also giving the Administration another weapon to combat the depression, actually the Administration has made minimum use of its inflationary provisions. The attempt of the United States to install silver in a position of importance in the world's monetary system, has been unsuccessful. The time is now ripe, therefore for Congress to revise our silver program, repealing the Silver Purchase Act, but with care so that the market situation which it has created should be so terminated as to cause the least disturbance to the price structure.

We must recognize the fact that silver is primarily not an exchange medium but an industrial and jewelry metal. In recent years, the efforts made to broaden its scope of usefulness have opened many new outlets which, although each may use only small amounts, in the aggregate build up to respectable totals.

Silver has been used to a fair extent for chemical equipment for many years. Its freedom from oxidation; its resistance to various commercial acids; its high thermal and electrical conductivities and its excellent mechanical characteristics have made it a valuable aid in such industries as acetic acid manufacture, in the food preparing trades, for beverages, in the manufacture of acetate rayon and others.

Continued investigation on the part of those interested in the progress of silver will undoubtedly open new fields. The combination of reasonable, stable prices and persistent effort is sure to succeed.

Business Progress

BUSINESS in the old year went out in high gear. Industrial activity rose to a new high point of the recovery period according to the National Industrial Conference Board. We are now in a seasonal dull stretch, but Spring improvement should be directly before us.

Prospects, according to competent observers, are encouraging. It is generally expected that season for season, 1937 will be better than 1936. An interesting straw which showed which way the wind is blowing was the talk on Trends of Distribution by A. W. Zelomek, economist of the International Statistical Bureau, Inc., and the Fairchild Publications, who pointed out to purchasing agents that they must generally adjust themselves to a sellers' market which is coming, instead of the buyers' market which has been in effect since 1929.

We are beginning to hear complaints which assure us that better times have come—shortages of skilled labor. Good polishers are hard to get; good machinists, die makers and molders are all working. To be sure we have still a huge unemployed population, variously estimated, but perhaps about 9,000,000. Most of these are unskilled labor so far as the manufacturing trades are concerned.

A reassuring and well balanced statement was issued on this problem by John W. O'Leary, president of the Machinery Institute, who pointed out that the shortage of skilled labor is a normal development rather than an alarming new problem. We have faced such a shortage after every depression. The need of finding suitable men to train for skilled jobs is constantly with us as long as business is normal. It should be met, not by emergency measures, but by continuously training apprentices who will be available for jobs which will become increasingly numerous as manufacturing activities continue to improve.

We have two dark clouds upon the horizon—labor troubles in the automobile industry and the floods in the Middle West. Whether they will delay, impede or possibly even prevent a good Spring season, we shall know within the next month.

Correspondence and Discussion

A Brass Foundryman's Progress

In looking through August edition of **Metal Industry** I read the letter of Otto Gerline, "A Brass Foundryman's Progress." I was very much interested in it. The letter to the dead father rather touched me, and I gave it to the Presbyterian minister to read. He had his stenographer write it and he is going to weave a sermon on it.

ISADORE STURROCK.

Great Falls, Mont.

Human Interest in a Brass Foundryman

To the Editor of **Metal Industry:**

I have clipped and preserved that article, (which has nothing to do with business), "Letter from a Foundryman to his Dead Father" which appeared in **Metal Industry** for August. I think that it is one of the finest things in the issue, both from a human interest standpoint and as a piece of writing.

V. D. GREEN.

Cleveland, Ohio.

New Books

Casting Manual for Non-Ferrous Metals, by Sam Tour and W. J. Reardon. Size 5¼ x 7⅞; 50 pages, published by Metal Industry Publishing Co. Free to subscribers of **Metal Industry.**

The first edition of this booklet was called, "Brass Founders' Manual," which appeared in 1935. It was the first attempt to compile, briefly and at the same time as comprehensively as possible, practical information on non-ferrous foundry practice. The present booklet (1936-1937) is the second edition. It includes all of the material published in the first edition, revised and brought up-to-date, and in addition a considerable amount of new data bringing it considerably ahead of the first.

The book is divided into a number of broad classes, depending upon the base of the alloys described: Copper Base Alloys, with 7 divisions; Aluminum Base Alloys with 6 divisions; Nickel Base Alloys with 2 divisions; Magnesium Base Alloys. In each division, the following data and directions are given: Specifications of the Metal Mixtures; Raw Materials; Sands; Molding, Melting and Pouring; Cleaning; Reclamation.

These chapters are followed by departments on Equipment, Sand Grading Classifications, etc.

In addition, several new classes have been included: Die Casting Alloys with three divisions (Aluminum Base Alloys, Zinc Base Alloys and Copper Base Alloys). These are described in the same fashion as the sand casting alloys: specifications; raw materials; melting and casting; dies and machines; reclamation; cleaning and finishing. Permanent Mold Castings are divided into Aluminum Base Alloys and Copper Base Alloys. Slush Castings include Lead Base and Zinc Base Alloys.

The booklet makes no pretense of covering the subject on non-ferrous casting operations completely and exhaustively. It is, however, a thoroughly trustworthy, accurate and adequate booklet on practical non-ferrous foundry operations. It is convenient in format, can be carried in the pocket about the plant and its contents are so conveniently classified that desired information can be found with a minimum of effort.

Transactions of the Iron and Steel Division, A.I.M.E. for 1936. Published by The American Institute of Mining and Metallurgical Engineers, New York. Size 6 by 9, 411 pages. Price $5.00.

The 1936 volume contains papers and discussions presented before the Iron and Steel Division A.I.M.E., at the meetings held in Chicago, October 1-3, 1935 and in New York, February 17-21, 1936. There are 19 papers including the Howe Memorial Lecture by H. F. Moore on "Correlation Between Metallography and Mechanical Testing." Besides the papers there are the proceedings of the Round Table on Qualities of Pig Iron, held in Chicago, October, 1935.

Arc Welding Handbook. Published by the Lincoln Electric Co. Size 5¾ x 9, 819 pages. Price $1.50.

The Procedure Handbook of Arc Welding Design and Practice, now in its 4th edition has been enlarged by 223 additional pages and 289 new illustrations. It has also been revised in the light of present day arc welding practice. The book is divided into 8 sections covering the following subjects: Welding Methods and Equipment; Technique of Welding; Procedure, Speeds and Costs for Welding Mild Steel; Structure and Properties of Weld Metal; Weldability of Metals; Designing for Arc Welded Steel Construction of Machinery; Designing for Arc Welded Structures; Typical Applications of Arc Welding in Manufacturing, Construction and Maintenance; Advertising Section.

Technical Publications

Tentative Code of Recommended Practices for Testing and Measuring Air Flow in Exhaust Systems. Code 36-27. American Foundrymen's Association, 222 W. Adams St., Chicago, Ill. Price $2.00 per copy.

Tentative Code of Recommended Practices for Grinding, Polishing and Buffing Equipment Sanitation. Code 36-28. American Foundrymen's Association, 222 W. Adams St., Chicago, Ill. Price $2.00 per copy.

Silver: Its Properties and Industrial Uses. Published by the National Bureau of Standards. Circular C412. Obtainable from the Superintendent of Documents, Washington, D. C.; price 10 cents.

This circular is arranged in three parts. The first part deals with physical, chemical and technologic properties of the pure metal. The second part presents the available data on a number of the commercially important alloys of silver with base metals. In the third part are discussed industrial uses of silver in three groups: electrical, chemical and bactericidal. A comprehensive bibliography citing the original sources of information is appended to each section of the Circular.

B. N. F. Jet Test for Determining the Thickness of Nickel and Other Coatings, by S. G. Clarke.

A method of testing the thickness of deposits of nickel and other metals described before the Electrodepositors' Technical Society on October 21, 1936. This method called the B. N. F. (British Non-Ferrous Association) jet test, is similar to the Hull and Strausser drop test, except that instead of allowing the test solution to drop on the specimen, a continuous stream of the solution is made to impinge on it. The apparatus required is simple.

A description of the method appears on pages 68-71 of this issue of **Metal Industry.** Details are given for a number of coatings tested, these including copper, nickel, bronze, cadmium, zinc and various combinations of these on different base metals.

Several bright nickel coatings were compared with ordinary nickel by means of this test. The deposit from Schloetter's solution, it is stated, dissolved more rapidly than ordinary nickel. For the Weisberg bright nickel, the rate of attack was normal. Variations in the conditions of deposition do not influence the results of the test, it is said, except in the case of two of the three types of bright nickel deposits tested, for which the rate of solution showed a sudden jump, approaching double that of the other nickel deposits.

In using this method to determine the thickness of nickel deposits, the type of solution from which the nickel is deposited must be taken into account. Presumably this is also true of the Hull-Strausser drop test.

Shop Problems

Questions from Readers Relating to Shop Practice and Answers by our Associate Editors.

Foundry
Mechanical
Metallurgical
Rolling Mill

Electroplating
Polishing
Metal Finishing
Reclamation

Black on Aluminum

Q.—We make a cast aluminum name plate, small in size. We should like to know if it is possible to oxidize this plate black? If so, how can this be done, and by an inexpensive method?

A.—A black color may be obtained on aluminum by immersing in the following solution:

Potassium permanganate	1½ oz.
Nitric acid 20 Be	1/3 oz.
Copper nitrate	4 oz.
Water	1 gal.
Temperature	175° F.

Time of immersion 20 to 30 minutes; dry and protect with clear lacquer.

A deposit of black nickel applied directly to aluminum will produce a coating that is sufficiently durable for interior service.

Nickel ammonium sulphate	8 oz.
Zinc sulphate	1 oz.
Sodium Sulphocyanate	2 oz.
Water	1 gal.

Nickel anodes, voltage 1 volt, cathode current density 1 to 2 amps; solution is maintained nearly neutral with zinc carbonate.

—T. H. C., Problem 5,551.

Blue Black on Brass

Q.—We manufacture a number of very small brass stampings that we have been finishing in blue black with a copper carbonate solution. We find however, that after cleaning a batch of these small brass stampings with hot cleaner, that many of them turn a sort of copper color and it seems that these copper colored pieces will not take the black finish very well. Can you advise us the reason for these pieces turning a copper color and why the copper carbonate solution will not blacken these pieces properly?

Also, would it be possible to put these stampings into some kind of a bright dip before attempting to finish them and thereby have better success? If so, could you recommend the best bright dip formula as we are novices in plating matters.

A.—In order to obtain a uniform color from an immersion dip it is absolutely necessary that metallic surface be free of oxide film that may be produced in the cleaning operation.

Such a film may be removed after cleaning and rinsing in cold running water, by dipping in a muriatic acid pickle; then rinsing again in cold water before immersing in coloring dip.

The muriatic acid pickle can be made by adding 10% muriatic acid by volume to necessary volume of water. The use of a bright dip after cleaning operation on parts will be of help in obtaining a more uniform color from copper carbonate immersion dips. A bright dip of the following composition may be used:

Sulphuric acid	2 gals.
Nitric acid	1 gal.
Water	1 qt.

Add 1 oz. muriatic acid for 5 gals. of above; water should only be added in making up new solution. It is essential that dipping solution be used in an acid proof stoneware crock and must be used cold. Cooling of dip may be accomplished by placing crock in tank with cold running water. In mixing of solution, the sulphuric acid must be added last and gradually so as to avoid overheating and tendency to spatter.

—T. H. C., Problem 5,552.

Dip Cadmium or Tin

Q.—We have on hand a considerable quantity of small music wire formings and which we are very anxious to cadmium plate. However, we are advised by plating firms everywhere that they cannot handle this job because they are in such a tangled mass. So under the circumstances, we would like to know if there is a dip process for these parts that we could use. We are able to separate them sufficiently into small bunches of about a quart or two quarts by volume and believe that we could do the plating if you would give us a dip formula since we do not have an electroplating outfit.

A.—We know of no satisfactory cadmium dip solution. A deposit of tin may be obtained by immersion methods which no doubt would be adequate. An immersion tin solution made as follows can be used:

Tin chloride	½ oz.
Aluminum sulphate	2 oz.
Cream of tartar	2 oz.
Water	1 gal.

The work is immersed in an iron wire basket, large quantities of work being separated by sheets of zinc. The tank is of copper or cast iron lined with sheet zinc. The work is boiled for 30-45 minutes. —T. H. C., Problem 5,553.

Light Pitted Nickel

Q.—Am sending under separate cover a sample of nickel sulphate solution which is used for still plating.

Please analyze this solution for metal, chloride, boric acid and the pH. Have been checking this solution with a colorimetric set for metal and pH but I do not have any luck in making the solution work. The solution doesn't seem to plate heavy and on larger work it pits.

The sample pieces enclosed with the bottle were in the tank two hours. I plate these ferrules on racks 20 pcs. to a rack, 480 pcs. in a tank full. This tank has two cathode rods and three anode rods. The anodes are 95-97 nickel cast.

I use approximately 6 volts at generator; voltmeter at tank shows approximately 2½-3 volts.

I have no ammeter at the tank, only at the generator which gives the amperage of all the tanks hooked on the generator. When I have all the other tanks off but this nickel tank the ammeter will show from 60-80 amps. which I feel isn't enough amperage, or doesn't the true reading of the amperage of this tank show on the generator ammeter? Generator is a 6 volt model.

A.—Analysis of solution:

Nickel	3.09 ozs./gal.
Chloride, as ammon. chloride	2.59 ozs./gal.
pH	6.2

The pH is too high. Add 2 fluid ounces of sulphuric acid to each 100 gallons of solution.

The chloride can be increased by adding ½ ounce per gallon of ammonium chloride.

The pitting can be eliminated by adding hydrogen peroxide or an anti-pitting agent.

You say you are using about 80 amps. to a load of 480 pieces of work. This figures out to a current density of 2 amperes per square foot on the size of piece furnished as sample. This current will deposit only about .0001″ per hour. This rate can be increased so that you are plating at 8 or 10 amperes per square foot. At 10 amperes per square foot you can deposit .0002″ of nickel in about 24 minutes.

The reason for not getting higher current with the size load you mention is due either to insufficient anode area, dirty connections, dirty anodes, or some similar source of resistance.

—G. B. H., Jr., Problem 5,554.

Nickel and Copper Analyses

Q.—I am sending you two samples for analysis:

(1) Nickel solution which is in fair working order with the exception of throwing power which is poor. Please analyze for metal, chloride as ammonium and boric acid, also pH. This sample is from a 300 gal. tank.

(2) Cyanide copper which is in a poor state. The deposit is cloudy and uneven of a brownish color. I use this bath for striking prior to nickel plating. The tank contains 125 gals. using 4 rolled copper anodes.

A.—Analysis of the nickel solution is:

Nickel	3.25 ozs./gal.
Chloride, as ammonium chloride	1.91 ozs./gal.
pH	5.8

This solution needs a little more chloride. Add one ounce per gallon of ammonium chloride. Outside of this the composition of the solution shows it to be in good condition. The poor throwing power may be due to poor connections and therefore not getting sufficient deposit, or to not having enough anodes in the tank. If these conditions do not correspond to what you have kindly furnish more details on the poor throwing power, furnishing a sample of the work and mentioning the current being used. Keep solution at 70° F.

Analysis of cyanide copper:

Copper	1.12 ozs./gal.
Free cyanide	.12 ozs./gal.

The copper is too low and the free cyanide much too low. Add 1 and 1/3rd ounces per gallon of copper cyanide and 2.5 ounces per gallon of sodium cyanide.

—G. B. H., Jr., Problem 5,555.

Nickel Plating and Ball Burnishing

Q.—We herewith enclose two samples and shall be very pleased if you will give us a detailed list of processes required and types of plant, to produce the exact finish that is upon these samples marked "A" and "B". Kindly say if sample "B" is lacquered.

A.—The samples submitted are nickel plated and ball burnished to obtain lustre. Neither sample has been given a protective coating of lacquer. In order to obtain such a finish the following detailed procedure should be followed:

1. Parts should be made of cold rolled steel of fairly smooth finish. A No. 2 cold rolled steel finish (U. S. Standard) is satisfactory.
2. Clean parts after fabricating in either a solvent degreaser or in a hot alkaline cleaner. Parts should be cleaned in baskets of proper size and mesh.
3. Ball burnish parts in either oblique open end or horizontal wood lined barrel; size depending upon quantity of parts. Burnishing mixture made up of about 2 oz. neutral soap chips or flake to 5 gals. of water, to which is added about 1 oz. sodium cyanide; hardened polished steel balls, 5/32″ to ¼″ diameter, using approximately twice the weight of steel balls to that of the weight of work. Rolling time dependent upon finish designed, varying from 2 to 12 hrs. Speed of barrels about 35 to 45 R.P.M.
4. After ball burnishing, parts should be rinsed first in boiling hot water to remove soap film and then rinsed in cold running water.
5. After cold water rinse, parts are placed in a plating barrel of suitable size and given a required deposit of nickel. A nickel solution of following composition can be used:

Single nickel salts	12 ozs.
Double nickel salts	4 ozs.
Ammonium chloride	3 ozs.
Boric acid	3 ozs.
Water	1 gal.
pH	5.8 to 6.0

Temperature 75-80° F., anodes 99% rolled, depolarized nickel.

Time of deposit at least 1 to 1½ hours depending upon size of load. It is necessary to use a line voltage of 12 volts to obtain most satisfactory results. This will necessitate the use of 12 volt D.C. generator.

6. After plating, parts are rinsed in cold running water.
7. After rinsing, parts are again ball burnished to obtain lustre. The same procedure should be followed as outlined in item No. 3 with these exceptions:
   1. The use of cyanide in soap solution should be eliminated.
   2. After hot water rinse, rinse in cold and in hot water and then finally dry in hot, clean hardwood sawdust. Burnishing time in soap solution between 20 to 30 minutes.

The recommendations as outlined above can be modified to suit conditions.

—T. H. C., Problem 5,556.

Plating Steel to Stop-Off Hardening

Q.—We pack-harden a number of low-carbon steel parts. Occasionally we find it necessary to prevent carburization of certain areas of these parts so that they may be further machined after heat treatment.

We have tried copper plating the areas to be kept soft, by means of a saturated copper sulphate solution to which a few drops of sulphuric acid have been added. The resulting copper coating has not been very satisfactory, however.

Can you suggest a more suitable copper plating solution? We prefer not to deposit the copper electrically. Any help which you can give us with this problem, and any suggestions which you may care to make regarding other means of preventing carburization of local areas will be greatly appreciated.

A.—It is not possible to put a coating on steel or iron by the method you describe that will be suitable for protection against hardening. The film of copper so applied is very thin and carburizing will take place through it.

The proper method is to apply a thickness of copper of .0005″ by means of electrodeposition from a cyanide solution. That thickness will be sufficient to allow of hardening the unplated areas to a thickness of case of ten one thousandths. (.010″).

A cyanide copper solution for this purpose can be made from:—

Copper cyanide	3.0 ozs.
Sodium cyanide	4.5 ozs.
Sodium carbonate	2.0 ozs.
Water	1 gal.

Operating details and other information can be found in the Platers' Guidebook published by the Metal Industry Publishing Co.

For heavier copper deposits, the copper plate can be built up to a greater thickness in an acid copper solution composed of:—

Copper sulphate	27 ozs.
Sulphuric acid	6.5 ozs.
Water	1 gal.

Before placing the work in this solution it is necessary to cover it with a coat of copper in the cyanide copper solution, as plating steel direct in the acid copper solution will produce a scaly non-adherent deposit.

—G. B. H., Jr., Problem 5,557.

Special Finish on Brass

Q.—I am sending your under separate cover two brass castings; one finished and one plain. I would like to duplicate the plain casting such as the aforementioned finished piece and would like to handle this in baskets of twenty-five to thirty pounds of castings.

Any information you may be able to give me on this will be greatly appreciated.

A.—The finished sample casting submitted has been first given a coating of copper bronze lacquer; then coated on one side with a smut of lamp black and turpentine, then a thin coat of clear lacquer to set smut, and rolled to relieve high lights and remove excess smut.

To be able to finish sample casting it would be necessary to spray copper bronze lacquer, black smut, clear lacquer and finally roll to relieve high lights thus preventing their being handled in bulk up to the last operation.

—T. H. C., Problem 5,558.

Practical Brass Foundry Digest

By H. M. ST. JOHN
Chief Metallurgist, Detroit Lubricator Company; Associate Editor, METAL INDUSTRY.

Short Abstracts of Articles of Interest to Practical Non-Ferrous Foundrymen and Metallurgists.

Metals and Alloys in Chemical Plant Construction. James A. Lee. Metal Ind., (London). Vol. 49, page 85 (July 24th, 1936).

A general review in a paper presented at the Chemical Engineering Congress of the World Power Conference.

A Study of Sprayed Metal Coatings. J. Fassbinder and P. Soulary. Metal Ind. (London), Vol. 49, page 89 (July 24th, 1936). The concluding installment of a paper presented at the International Congress of Acetylene, Oxy-Acetylene Welding and Allied Industries. See previous abstract.

Copper-Tin Alloys in Power Transmission: Centrifugal Casting of Bronze Gears. R. C. Stockton. Metal Ind. (London), Vol. 49, page 103 (July 31st, 1936).

Gear bronzes have had to keep pace with the development of the special steels used with them. They contain from 6 to 14% tin. Lead and zinc should be absent from heavy-duty material. Lead may be used up to 10% for light duty, in contact with unhardened steel, when there is a possibility of seizure. Zinc, except as a deoxidizer, is tolerated only when the soundness of the casting is more essential than its resistance to abrasion. Phosphorous used for fluidity, rarely in excess of 0.3%. Nickel, a relatively new constituent in this class of alloys, is valuable because of its grain-reducing influence but should be proportioned with care to suit the particular job in hand; about 1.5% is generally suitable, substituted for copper, not tin. The optimum pouring temperature is 1090 to 1150°C (1994 to 2102°F). Centrifugal casting, around a vertical axis at 700 R.P.M. or more for a 12 inch mould diameter, has great advantages. Depending upon the mould temperature employed, the best casting temperature for centrifugal work lies in the range 1170 to 1270°C (2138 to 2318°F).

The Durability of Moulding Sands: An Investigation of Three Testing Methods. Metal Ind. (London), Vol. 49, page 106 (July 31st, 1936). Abstracted from a bulletin of the Engineering Experiment Station at the University of Illinois, by C. H. Casberg and C. E. Schubert. See recent abstract.

Properties and Alloys of Beryllium. Louis L. Stott. Metals Technology. Vol. 3, Aug. 1936. Paper presented at Feb., 1936, meeting of A.I.M.E.

The properties of the pure metal and its useful alloys are discussed in detail. Most of these can be age hardened to a marked degree. Sand castings containing 0.4% beryllium, 2.6% cobalt, balance copper, can be heat treated to an average tensile strength of 95,000 lbs. per sq. in., with an electrical conductivity above 45% that of copper. The castings are quenched from 1650°F and heat treated at 850 to 950°F. An alloy of 70.44% silver, 28.9% copper and 0.87% beryllium, quenched from 1400°F and held for 6 hours at 625°F develops a hardness of Rockwell B 91.5 and a conductivity of 66.3%. Others of the alloys containing silver show tensile strengths in excess of 150,000 lbs. per sq. in. but lower conductivities. Alloys containing nickel and manganese, the ferrous alloys, and alloys with the precious metals are also described. Beryllium has also been employed as a deoxidizer and desulphurizer.

Beryllium and Its Alloys. Jack Delmonte. Metals and Alloys. Vol. 7, page 211 (Aug. 1936). Continued from the July issue; see recent abstract.

A theoretical discussion dealing principally with the wrought metals.

Recommended Practices for Sand Cast Magnesium Alloys. Report of A.F.A. Nonferrous Division Committee on Recommended Practices. Trans. Amer. Foundrymen's Assoc., Vol. 7, Aug. 1936, page 33.

Recommendations cover the following: molding, melting and pouring, finishing, heat treatment, defects—their causes and prevention, chemical control limits, physical properties, specifications, development and field of use. See **Metal Industry,** November 1936, pages 426-30; December 1936, pages 471-3.

Deformation and Resilience of Molding Sand. H. W. Dietert and R. A. Dietert. Trans. Amer. Foundrymen's Assoc., Vol. 7, Aug. 1936, page 139.

These properties of molding sand, which have received scant attention, are discussed with particular reference to iron founding but are evidently of general importance.

Radiography of Metal in Principle and Practice. Kent R. Van Horn. Metal Progress, Vol. 30, Aug. 1936, page 45.

The author describes the technique of use in the employment of gamma rays and X-Rays for the examination of castings. Gas porosity, shrinkage porosity, misruns, sand inclusions, shrinkage cracks and strain cracks may be identified and distinguished one from another. Gamma rays, because their use is inexpensive and time-consuming, are likely to be used principally for the examination of material opaque to the X-Ray or inaccessible to X-Ray equipment.

Light Aluminum Alloys Containing Nickel. Aluminum & The Non-Ferrous Review. Vol. 1, page 504 (Aug. 1936). Abstracted from the July 1936 issue of the Nickel Bulletin.

Aluminum-nickel alloys can be produced in wide variety and all of the usual forms. They possess many useful properties for industrial application. The properties and uses of the more important of these alloys are discussed in detail.

Founding Magnesium Alloys. Dr. J. A. Gann and M. E Brooks. Metal Ind. (London), Vol 49, page 127 (Aug. 27th, 1936). A paper presented before the American Foundrymen's Association.

Low-carbon cast-steel pots are used for melting. The molten alloy floats on a bath of flux which normally consists of 60% anhydrous magnesium chloride, 40% sodium chloride. A film of flux covers the surface of the metal and also separates it from direct contact with the melting pot. The metal is puddled with the flux to remove impurities. Molten metal is dipped out as needed for casting, additional solid metal charged to take its place. For casting in green sand, sand addition agents such as sulphur, boric acid and ammonium fluoride must be mixed with the sand to prevent oxidation of the metal by water in the sand. Properties and uses of the various alloys, which usually contain aluminum, manganese and sometimes zinc, are discussed, together with methods for their heat treatment.

Sand Castings of Copper-Silicon Alloys. H. A. Bedworth and V. P. Weaver. Metal Ind. (London), Vol. 49, p. 139 (Aug. 7th, 1936). A paper presented before the American Foundrymen's Association.

See previous abstracts.

Modern Equipment

New and Useful Devices, Metals, Machinery and Supplies.

Metal Spinning Lathes

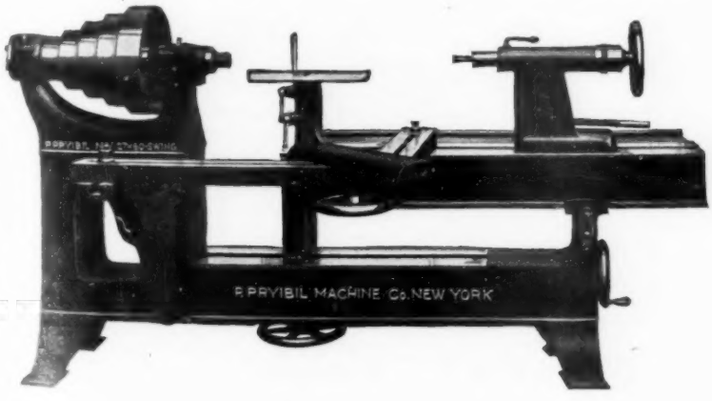
One of the oldest manufacturers of metal spinning lathes is the P. Pryibil Machine Co. Their line, now being manufactured by S. S. Hepworth Co., 41-31 Vernon Blvd., Long Island City, N. Y., consists of two general divisions —belt driven and motor driven lathes.

The belt driven lathes are of the straight bed, and extension bed gap types. The straight bed lathes run in size from 15" to 26" with the length of bed from 54" to 74" and the distance between centers 24" to 34". Horsepower required, 2 to 5; diameter of face plate furnished, 5¾" to 9⅝".

Extension bed gap type lathes can be furnished in various sizes: 22" x 44"; 27" x 60"; 32" x 72"; 32" x 96". The construction of the head and tail stock are identical in design with the straight bed type machines although of larger dimensions. The bed, however, is different. Its upper section slides on its lower section, adjustable by a screw with hand wheel in the lower bed.

This type of lathe can be used on oval work and an auxiliary bed of "L" shape can be used for spinning articles of large dimensions.

Pryibil Straight Bed Spinning Lathe



Pryibil Extension Gap Lathe

Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

New Insulating Brick. "JM-20." For use in furnaces where there is no flame impingement, slag action or mechanical abrasion, at temperatures up to 2000°F. Johns-Manville Corp., 22 E. 40th St., New York City.

"End-Shak" Testing Sieve Shaker. For testing fine materials. Newark Wire Cloth Co., Newark, N. J.

Forms for Simplified Record Keeping for the Social Security Act. Acme Card System Co., 8 S. Michigan Ave., Chicago, Ill.

Instrument for Measuring Furnace Atmosphere Quality. Analy-Graph, operating on principle of measuring the thermal conductivity of the gas mixture, which is continuously drawn from the furnace. Brown Instrument Co., Philadelphia, Pa.

Quick Flow Meters, for steam, liquids and gases. Bristol Co., Waterbury, Conn.

Motorblower, Type CS. Specially designed to meet the needs of the numerous services requiring air at 1-lb. pressure and in volume from 325 to 3200 cubic feet per minute. Ingersoll-Rand Co., Phillipsburg, N. J.

Protecto-Seal, for packages. A metal cup in which is inserted a printed cardboard disc. Protecto-Seal Co., Inc., P. O. Box 44, Orchard Park, N. Y.

A back geared headstock can be supplied.

The motor driven lathes, it is stated, are custom built and not assembled from various units by different manufacturers. These lathes are made for heavy duty work. The headstock is self contained, motor driven with the headstock built around the rotor and stator. A hand wheel is located immediately behind the front bearing of the headstock, convenient for mounting chucks and for turning the spindle by hand while inspecting the work. The brake is so designed that a pull of the lever applies it, cutting out the motor. It is impossible to start the motor with the brake applied.

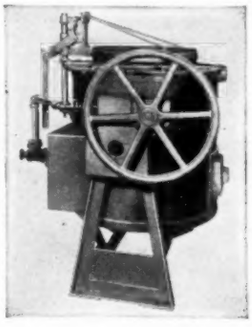
Various speeds are obtained by means of a controller located in the left leg or pedestal. It has five positions, four for speed changes and one neutral or stop. A red pilot light is located on the front of the pedestal, easily seen.

The Pryibil lathe, it is stated, is a compact, self-contained unit. After placing it in the desired position, all that is necessary is to run leads to the starter box and the machine is ready for operation.

PDM Met-L-Melt Furnaces

In designing the PDM standard line of tilting and stationary furnaces, of which there are ten sizes, considerable deviation, it is stated, has been made from the usual method of construction. This was necessary due to the unusual demands placed on furnaces of this type by modern production methods, which require higher grades of metal, greater speed of melting, long crucible and lining life, improved working conditions, and still be comparatively low in first cost.

PDM Met-L-Melt furnaces are recommended for melting aluminum, brass, monel, nickel and iron, and can be either oil or gas fired. They are lined with silicon carbide linings and insulated with high temperature insulating brick as standard, although they can



PDM Metal Melting Furnace

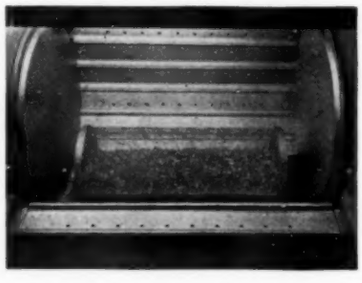
be supplied with monolithic or firebrick lining, if desired.

These furnaces are made by the Philadelphia Drying Machinery Co., Phila., Pa., Industrial Furnace Division.

Cleaning Minute Metal Parts

Small metal stampings weighing as little as 1/283 of one ounce are being cleaned successfully, it is claimed, in American Wheelabrator Tum-Blast equipment, manufactured by the American Foundry Equipment Company, 555 South Byrkit Street, Mishawaka, Indiana, preparatory to nickleplating.

These stampings are cleaned in cylindrical wire mesh baskets which roll over and over in the abrasive blasting zone, causing a constant turning and cascading of the tiny stampings and exposing them to the scrubbing action of the blast. Wire baskets are constructed of number six mesh wire with solid ends made of 14 gauge steel. A gate for filling or emptying the baskets is firmly bolted to one end. The wire mesh used in the design of the basket is large enough that it will not retard the efficiency of the blast to any great extent and is small enough to prevent the eescape of the tiny metal parts. Theoretically these wire baskets are used as auxiliary, horizontal barrels in conjunction with the Wheelabrator Tum-Blast. Fine number ninety steel grit is the abrasive used for the cleaning of these small parts. A surface suitable



Basket for Blast Cleaning Small Parts

for nickle plating is said to be obtained after only thirty minutes of wheelabrating.

New Type of Hard Solder Flux

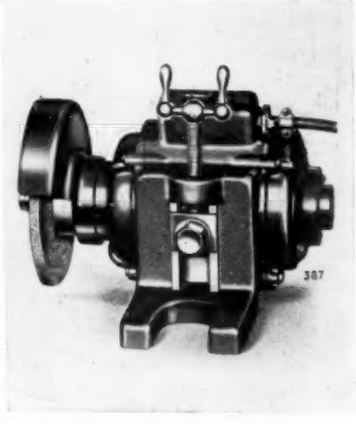
The Special Chemicals Corporation, 30 Irving Place, New York, announces a new development which is now being placed on the market, a flux known as Spekflux, patents for which are pending. It is claimed to be the fastest acting hard solder flux for soldering, brazing, or welding almost all types of metals, such as stainless steel, steel, iron, copper, brass, bronze, platinum, gold, silver, monel metal, nickel, German silver etc.

Spekflux melts at low temperature, resists evaporation at high temperature, and the solder flows freely along the joint. Fluxing action starts at 212° F. and has a flowing point from 785° F. to 1600° F. and over. Spekflux, under high temperature, it is stated, does not evaporate and functions thoroughly and efficiently for high melting point solders; does not lump or pit solder. Under all conditions, excess flux washes off quickly in hot water, saving cleaning time.

Quick action is claimed for Spekflux which saves both labor and gas. Those skilled in the art of soldering, brazing and welding are fully acquainted with the precautions that should be taken to guard the worker from any toxic action due to the ingredients of fluxes. Spekflux, it is stated, safeguards the worker from harmful toxic action.

Angle Plate Grinders

The illustration below shows one of a new line of Hisey motor driven angle plate grinders, made by the Hisey-Wolf Machine Co., Cincinnati, Ohio. These machines are new in every detail, embodying many mechanical and electrical



Angle Plate Grinder

refinements. The following are some of the improvements stated:

Precision ball bearings throughout mounted in accurately ground housings.

Commutating type repulsion induction motors for single phase service.

Double lock nuts throughout, permitting operating machine in either direction of rotation with safety.

Heavier spindles.

Larger wheel arbors.

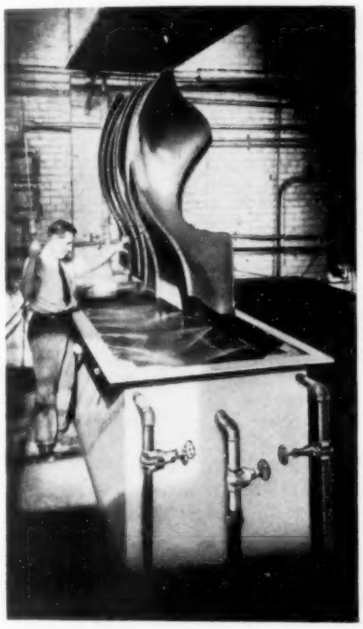
Square thread feed screw.

External cable connector.

These Grinders are designed to be attached to the tool post of a lathe, the vise of a milling machine, or head of a shaper, planer, boring mill, etc.; made in six sizes, from ¼ to 5 H. P. capacity.

Increasing the Utility of Chemical Rust-Proofing Processes

Until recently, practically all of the chemical rust-proofing processes in commercial use were formulated to react on iron and steel only. However, one of the largest concerns in the business of producing rust-proofing chemicals recently announced a new process



Dip-Spra Bonderite Tank Installation

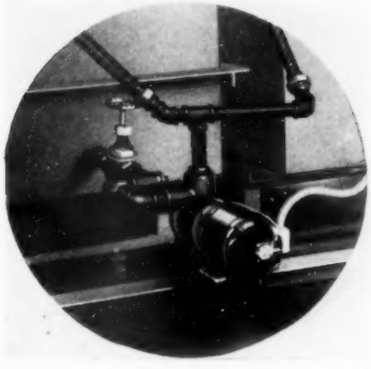
for producing a corrosion inhibiting coating on galvanized, zinc alloy and cadmium surfaces, as well as on iron and steel.

In addition to being corrosion resistant, the coating is said to be highly adherent, being integral with the metal itself, and having slight porosity, to form an ideal base for any type of paint finish.

This process is called Dip-Spra Bonderizing by its sponsors, the Parker Rust-Proof Company, Detroit, Mich. It is a new method of application, whereby the effectiveness of a prior process, Spra-Bonderizing, is adapted to the needs of the producer, whose requirements do not justify the installation of conveyor equipment.

This new process is recommended to manufacturers whose products must be painted, especially those who have had some difficulty in getting effective adherence of paint to galvanized or other zinc coated surfaces. It is claimed that the coating produced by this process will increase the paint holding efficiency from five to seven times, and that this has been demonstrated by many accelerated tests in the Parker laboratories.

The equipment requirements are said to be comparatively simple and easy to install, consisting only of a steam heated processing tank of suitable size, in which a spray pipe is placed above the solution level. This spray pipe is plain stainless steel, drilled with a series of 1/8" holes from 2" to 4" apart, through which the solution is circulated by a small pump, placed at one end of the tank. Large or deep tanks are fitted with a spray pipe on each side.



Small Pump for Circulating Solution

New pH Meter

Modern pH control, such as carried out in the up-to-date plating plant has been greatly simplified by the introduction of instruments equipped with glass electrode. Among such instruments the new Beckman pH meter, Fisher Scientific Company, 709 Forbes Street, Pittsburgh, Pa., has, it is claimed, gained wide acceptance during the past year. It has a glass electrode with comparatively heavy membrane which can be handled very much like an ordinary piece of glass ware, without breaking, and no delicate galvanometer is required for measuring the current.

This has been made possible by employing instead of the usual galvanometer, a specially designed vacuum tube amplifier which steps up the current passing through the glass membrane to such an extent that only a minute impulse is required to give a high sensitivity. It is therefore not necessary to work with an onion skin membrane to get a reliable reading. The amplifier also operates as a null instrument, and it is therefore not necessary to keep its characteristics constant to get exact results. Furthermore, the amplifier is so designed that it gives continuous readings, eliminating the annoyance of the ballistic method.

In common with all glass electrode instruments the Beckman pH Meter can be used in the presence of oxidizing and reducing agents, colloidal and suspended matter, in colored and opaque solutions, and in liquids containing dissolved gases. It can be employed for any measurements up to pH 12.5.

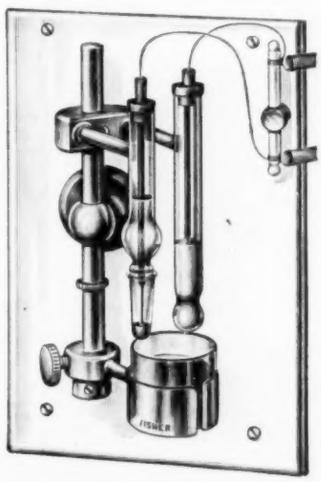
The electrode system consists of a glass electrode and a saturated calomel electrode. The latter makes contact

Beckman pH Meter

with the unknown solution through a carefully ground joint, a method which gives, it is stated, great constancy and reproducibility of results, and prevents contamination of the sample by the electrode solution.

A built-in temperature compensator, with a range from 0° to 40°C., can be set to give automatic compensation for temperature effects over the entire pH range. Simple and convenient adjustment for the assymmetry potential of the glass electrode is provided by means of a zero adjuster.

The electrical system of the Beckman pH meter is accurate to 0.01 pH and dial readings can be estimated with that degree of accuracy. To obtain readings of such accuracy very careful attention must be given to the main-



tenance of uniform temperature and care of the electrodes. With reasonable care an accuracy of about 0.03 pH should be expected. Outside electric disturbances from motor generator sets, rectifiers, bus bars, etc. without effect, as the instrument is perfectly shielded, and it is not affected by the shocks and vibration commonly encountered in an electroplating plant.

The entire instrument is contained in a 10 x 8 x 9 inch walnut case. A shielded compartment in the front houses the electrode assembly, and a small support fastened to the door eliminates the need of extra equipment. The door of the compartment is automatically locked when the lid is closed, and it cannot open while the instrument is being carried. Another safety feature is a spring on the lid which shuts off the current when the lid is closed.

For readings above pH 10 the instrument should be calibrated with buffers having approximately the same concentration as the solution to be tested. For the highest accuracy it is recommended that the electrodes be occasionally checked against a standard buffer.

Carboy Emptying Device

Recommended for the industries where poisonous and destructive liquid chemicals are used is a new carboy dumper, made by the Belke Mfg. Co., 947 N. Cicero Ave., Chicago, Ill. This new device picks up the carboy and empties it completely without losing a single drop of acid or changing the position of the bucket. This is accomplished by two centers of rotation which enables the pouring stream to take place in a single spot.

The operator is always at a safe distance from the bucket and is consequently protected from dangerous acid burns or blinding ammonia fumes.

One of the important features of the carboy dumper is that it is mounted on rollers and can be quickly rolled out of the way when not in use. It is stated also that one man can easily pour out the necessary quantity of acid without the usually necessary additional helper.

Belke Carboy Dumper

Waste Pickle Liquor Evaporated in Rubber-Lined Tank

A large Ohio manufacturer was faced with the problem of disposing of its waste sulphuric pickle liquor. A system was devised whereby the liquor was piped to a large outdoor tank. Here, by means of steam coils, it was held at a temperature of 210 to 220° F. until completely evaporated.

Rubber-Lined Pickle Evaporator

The original installation consisted of a large concrete tank. This did not prove satisfactory, however, due to the fact that the concrete was constantly cracking from contraction or expansion, permitting waste liquor to leak out onto the ground which caused an undesirable working condition.

This tank was replaced in July, 1936 with a 6500-gallon steel tank of all-welded construction which was lined with a ¼-inch thickness of Triflex rubber. This lining, which is a product of The B. F. Goodrich Company, Akron, Ohio, consists of a layer of hard rubber vulcanized between two layers of soft rubber. It is provided with built-in expansion joints which permit lining to contract or expand without danger of cracking. As a protection against excessive heat or physical damage, lining is covered with a special brick sheathing.

During the six months tank has been in service no difficulty whatsoever has been experienced with leaks. Due to the fact that the tank has no overhead protection, it is planned to maintain a low steam pressure in the coils throughout the winter months while tank is empty to prevent any water which might collect from freezing and causing damage.

Novelty Finishes Discussed By Klinkenstein

The wide variety of attractive "novelty" finishes now available to manufacturers was described and illustrated in a talk given before the January meeting of the Boston Branch of the American Electro-Platers' Society, by Gustave Klinkenstein, Vice-President and General Manager of Maas & Waldstein Company, lacquer and enamels manufacturers, Newark, N. J.

Mr. Klinkenstein pointed out that the beautiful finishes invented by the ancient masters of lacquering, gilded and blazed china, cloisonne work, etc. can now be reproduced rapidly and economically with modern lacquer finishes, and that many radically new finishes are constantly being developed.

The checked surface of old wood or china can be imitated, Mr. Klinkenstein said, by spraying the product with a coat of colored lacquer enamel followed by a coat of Checklac, a lacquer that cracks open on drying. Another type of lacquer, known as Prismlac, becomes ornamented with crystals when drying, and these crystals grow larger and cover the entire surface. Very interesting finishes can be obtained with this lacquer, used either clear on polished metals or in combination with colors, bronze powders, etc.

The brilliant metal colors formed by the anodic and other chemical processes can now be readily reproduced with a semi-transparent lacquer called Platelustre. With this lacquer, all known chemical color effects can be reproduced and many new ones can be secured.

Very different is the "flock" finish,

formed by spraying a special ground-coat, that remains sticky for 15 minutes, with finely divided cotton or rayon with a special type of spray gun. The finish thus secured looks like and wears like suede leather.

Metalustre is a new type of lacquer which combines the brilliance of a metal background with color. It is used extensively in finishing low priced novelties for the reason that it gives an excellent coverage in a single, quick-drying coat.

Other finishes described by Mr. Klinkenstein included mottled pearl, stipple and float finishes, crackly finishes and webbing lacquers which string out in fine threads when sprayed.

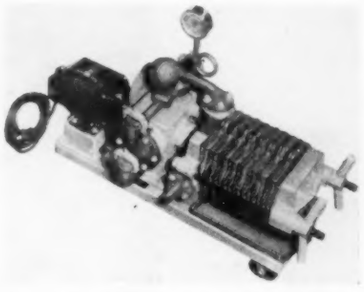
Filter for Plating Solutions

A new small portable filtration unit has been developeed by T. Shriver & Company, Harrison, N. J., which is said to meet the needs of many plating plants for equipment which can handle a nominal quantity of plating solution from small tanks on a continuous basis or from larger tanks on an intermittent basis insuring complete elimination of sediment and contamination from plating tanks.

This complete equipment consists of a Shriver plate and frame type pressure filter of 8 chambers, a Shriver Diaphragm Pump with strainer, direct connected to a ¼ H. P. motor, together with starting switch cord and electric plug, all mounted on a portable stand on roller bearing casters.

As an 8 chamber filter, it will filter up to 90 gallons of plating solution per hour. The plates and recessed solid frames of the filter and all pump parts coming in contact with the fluid are made of hard lead, which is most suitable for withstanding the corrosive characteristics of nickel, bright nickel and similar plating solutions. These same exposed parts may be made of cast iron rubber or other materials which may be more suitable for other solutions such as cyanide, acid copper, etc. The filter is clothed with cotton or wool filter cloths, as desired.

This compact portable unit measures overall only 35" long, 16" wide. Larger units for greater capacity are also available.



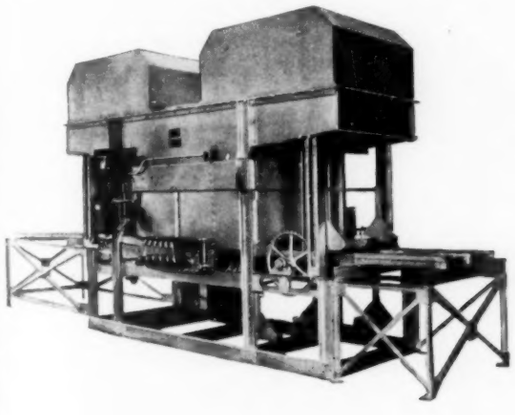
Portable Plating Solution Filter

Automatic, Vapor-Type Degreaser

The automatic, conveyorized, vapor-type of Detrex Degreaser illustrated has been recently designed and built by the Detroit Rex Products Company, 13022 Hillview Ave., Detroit, Mich., for the cleaning of heavy gauge metal parts.

This machine is equipped with a two-strand, cross-rod type of conveyor, which has a variable speed drive. There are 17 special fixtures suspended from this conveyor on 30 in. chain centers to handle the work baskets through the degreaser. Roller-type gravity conveyors at each end of the machine provide automatic loading and unloading.

Electric immersion heaters, and thermostatically controlled magnetic relay and line switch are used. The machine is also equipped with a full automatic vapor level control device.



Automatic Vapor-Type Detrex Degreaser Used for the Production Cleaning of Heavy Gauge Metal Parts

This model of degreaser is built in various sizes to accommodate production requirements. The particular machine shown is 20′ long, 6′ 3″ wide by 9′ 8″ high. It has a rated production capacity of over 6,000 lbs. of heavy gauge metal parts per hr. at a conveyor speed of 1 ft. per minute.

Parts are received on the gravity roller conveyor loaded in grill-type metal baskets having perforated plate separators. These work baskets are automatically lifted from the conveyor fixtures and carried through the machine. While in the machine, the parts are subjected to vapor cleaning in pure solvent vapor—either Perm-A-Clor or Triad Safety Solvents being used. The baskets of work on being conveyed out the opposite end of the machine are automatically transferred onto the gravity rolls at the exit end. From here they are conveyed to the following heat treating or finishing operations (depending upon the requirements of the work).

The complete cycle of vapor cleaning requires only about 4½ minutes. The work is removed from the machine perfectly free of oil and dry.

New Primer Permits Color-Finishing of Chromium

Chromium is notably difficult to lacquer or enamel. However, by the use of a new primer, recently developed by Maas and Waldstein Company, lacquer and enamel manufacturers, Newark, New Jersey, it is stated that chromium can be finished in any desired color.

The new product, known as "Chroprime", is a clear primer which can be applied to the metal surface by spraying or dipping, after which it is baked. It adheres tenaciously to the metal and provides an excellent foundation for any kind of lacquer enamel. It resists heat, remains flexible, and permits the metal to be engraved after it is applied. It is at present finding extensive application in the production of automobile name-plates and for other purposes where colors are wanted on a corrosion-proof base. Chroprime can also be used as a durable undercoat for finishing other metals.

New Polishing Wheel Abrasive

Few companies realize that their efforts to keep polishing wheel maintenance costs at a minimum are defeated by their use of ordinary cement or glue as an adhesive. Polishers all over the country whose production schedules permit no "bottleneck" due to undependable wheel "set-up" have demanded a better polishing wheel adhesive.

"Flexogrip" is Udylite's latest contribution to better polishing; it is claimed, a vastly improved polishing wheel bond. Flexogrip does not chip or break off, it is stated; because an integral part of wheel and grain. Result, longer wheel "head" life.

The advantages claimed for Flexogrip over other cements and glue are:

Requires no thinner; is applied as received. Extremely low surface tension and high penetrating qualities permit it to seep not only into the fibres of wheel or belt material, but into the pores of abrasive grains as well; perfect affinity between wheel or belt and abrasive grain.

Hardens rapidly under heat. This makes it possible, when necessary, to force dry wheels and speed up the wheel setting up operations. Friction heat generated in operation causes Flexogrip to become brittle and fracture into small areas when the wheel runs and comes in contact with the work. Fresh cutting edges of the grain are in this manner exposed to the work, giving faster as well as more open cutting results.

Less tendency to crowd or fill up when polishing soft metals; a longer wheel head life and less change of ridging or greying the work.

Minimum wheel glaze and prevents wheel burns. Glue softens under heat allowing grain to sink in and eventually glue instead of grain comes in contact with the work. Result, streaking and discoloration of work, it is stated, not obtained when Flexogrip is used.

Minimum polishing wheel set-up time. It eliminates glue pots, the soaking and cooking of glue and heating of grain.

Flexogrip, it is claimed, not only extends the life of the polishing wheel but also eliminates the necessity of carrying an overlarge stock of extra wheels.

Flexogrip is furnished in two types. Type A—specially formulated for grains coarser than No. 80. Type B—for abrasive grains finer than No. 80 up to and including FF grade abrasives. It is shipped in standard steel sealed containers in 25, 50 and 100 lb. lots from Detroit, Michigan. Inquiries may be addressed to any one of the Udylite Company branch offices in New York City, Chicago, Cleveland or San Francisco or direct to main office of the Udylite Company at 1651 East Grand Blvd., Detroit, Michigan.

Automatic Sprayer for Enameling Plants

The Edison General Electric Appliance Co., Inc., Chicago, recently installed an automatic spraying machine in their porcelain enameling plant, where their ranges, water heaters, etc., are manufactured. Plus machine, made by the Binks Mfg. Co., 3114 Carroll Ave., Chicago, Ill., is said to constitute a very definite improvement over the old swinging arm type, giving an absolutely even and perfect coat.

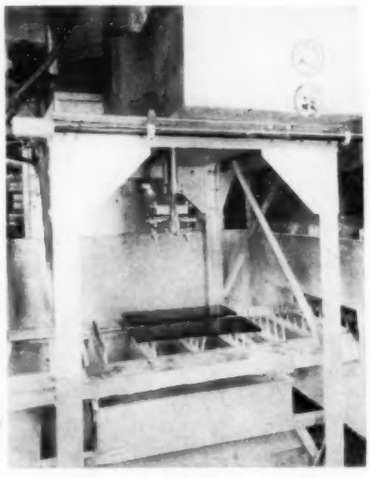
The automatic spraying assembly consists of a moving sprayer head, which has 4 spray nozzles of the type used on ordinary hand spray guns, adjusted to give a flat, fan shaped spray. In operation the entire spraying assembly moves back and forth at a regulated rate of speed across the conveyor carrying the ware to be sprayed.

A very interesting improvement is that the spray is automatically shut off each time it crosses the ware as soon as it reaches the edge of it, and is automatically turned on again as soon as it reaches the edge again on the return trip. The points at which the spray is turned off and on may be adjusted for various widths of ware.

The exhaust on the automatic spraying system is downdraft. This has a definite advantage over the conventional updraft or sidedraft reclaiming systems, as the dust and extraneous matter is pulled down away from the wet surface and so cannot stick on it and cause defects. Dry enamel cannot drop onto the wet surface from the pipes above.

The machine is 36 feet long, equipped with a conveyor which carries the ware from the loading end until it is unloaded after spraying. There are two manual spray booths on the line, where hand operators spray the ends and sides of flanges, and the back of pieces where it is necessary.

In preparing the machine for operation it is necessary to adjust the speed of the conveyor and the speed of the spraying assembly until the desired weight of coat is applied, and for the width of ware to be sprayed. The weight of application is measured in grams per square foot. Once this is adjusted the machine will, it is claimed, give an absolutely uniform coating for hours at a time. The machine is usually readjusted when using a new supply of enamel. These adjustments require only a few seconds.



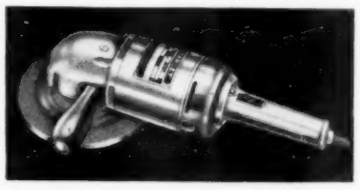
Automatic Spray Installation

With the conveyor moving at a speed of 20 feet per minute the machine applies a 35 grams per square foot coat on miscellaneous flat pieces. For the past year the company has been covering a large quantity of its ware with a "one cover" coat. As this one cover coat is sprayed at 35 grams per square foot, an advantage readily can be seen, compared to the 20 grams per square foot for the first cover coat and another 18-20 grams per square foot for the final coat on "two cover" ware. This makes a weight of 38-40 grams per square foot on two cover coat ware as compared to only 35 grams per square foot on the coat sprayed by the automatic machine. The thinner enamel reduces chipping and other defects, and reduces enameling costs about one-third below those of two coat ware.

Hand operators are required to spray edges of flanges and the backs of pieces which require spraying in order to prevent warping. On such work two operators are required in order to keep up with the speed of the machine—one spraying the backs of pieces and flanges on two sides, and the other spraying flanges on the other two sides. It is also necessary to have two operators to load and unload the conveyor.

New Electric Disc Sander

The Stanley No. 77 Electric Disc Sander is said to be a rugged, powerful tool designed and built for production and repair work. It is ball bearing equipped throughout, sturdily constructed, streamlined for use in close places and light in weight. It has a high speed universal motor enclosed in a strong aluminum alloy housing. It is furnished complete with a 7 inch flexible pad, 12 sanding discs (6 for metal and



Stanley No. 77 Disc Sander

6 for wood), wrenches, and a heavy rubber covered 3 conductor cable.

The Stanley No. 77 Sander, equipped with available accessories is recommended as a versatile tool, to scour and clean vats, polish metal pipes, remove labels and stencils, sand wood and metal, remove paint and rust, rub and polish lacquered surfaces, grind heavy welds, re-surface desks, smooth concrete, limestone and similar materials, and to smooth castings, auto fenders, etc., before and after filler is applied.

Manufactured by Stanley Electric Tool Division, The Stanley Works, New Britain, Conn.

Oxidizing Nickel Silver

Announcement is made of the discovery by John H. Lynch of the Electroplating Department of the Hookless Fastener Co., Meadville, Pa., of a simple method of oxidizing nickel silver. The announcement states that the method is inexpensive and that the finish is unusually resistant to wear.

Associations and Societies

Institute of Metals Division

29 W. 39th St., New York

Nominations for the officers of the Institute of Metals Division, A. I. M. E., have been made for the coming year as follows:

Chairman: Albert J. Phillips, Supt. Research Dept., American Smelting & Refining Co., Maurer, N. J.

Vice-Chairman: R. H. Leach, Manager, Handy & Harman, Bridgeport, Conn.; **Robert F. Mehl,** Director, Metals Research Laboratory, Carnegie Institute of Technology, Pittsburgh, Pa.

Secretary: Louis Jordan.

Treasurer: to be appointed by the Executive Committee.

Members of Executive Committee, 3 years:

E. E. Schumacher, Metallurgist, Bell Telephone Laboratories, 463 West St., New York.

Carl E. Swartz, Cleveland Graphite Bronze Co., Cleveland, O.

E. M. Wise, Asst. Mgr., Research Laboratory, International Nickel Co., Bayonne, N. J.

The Annual Winter Meeting of the Institute of Metals Division A.I.M.E. will be held at 29 W. 39th St., New York, Feb. 17-18th. The Tentative program is as follows:

Wednesday Morning—Feb. 17.

Orientation

The Stereographic Projection in Metallurgy. By C. S. Barrett.

Studies Upon the Widmanstatten Structure, IX.—The Mg-Mg_2Sn and Pb-Sb Systems. By Gerhard Derge, Robert F. Mehl and Arthur R. Kommel.

Lattice Relationships Developed by the Peritectic Transformation Alpha plus Liquid to Beta in the Cu-Zn System. By Alden B. Greninger.

Wednesday Afternoon

Properties of Alloys

Lightweight Alloys for Piston-ring Holders Based on Sliver. By Claus G. Goetzel.

Lead Coating of Steel. By J. L. Bray. (T.P. 788).

The Fatigue Properties of five Cold Rolled Copper Alloys. By William B. Price and Ralph W. Bailey. (T.P. 786).

Properties of Alloys of Cadmium and Mercury with Small Percentages of Nickel. By Telfer E. Norman and Owen W. Ellis.

Wednesday Afternoon (4 o'clock)

Refractories. Annual Lecture of the Division. By R. S. Hutton.

Thursday Morning

Deformation

The Influence of Temperature on the Elastic Limit of Single Crystals of Al, Ag, and Zn. By Richard F. Miller and W. E. Milligan.

Stress—Reduction-in-area Relations for the Cold Working of Metals in Tension. By Charles W. MacGregor.

Equipment for Routine Creep Tests and an Example of Its Application. By J. Ruzicka.

Thursday Afternoon

General Physical Metallurgy

Thermodynamic Calculations Concerning Certain Alloys of Tungsten and Molybdenum with Other Elements. By W. P. Sykes and H. A. Schwartz.

Thermal and Electrical Conductivities of Aluminum Alloys. By L. W. Kempf, C. S. Smith and C. S. Taylor.

Kinetics of Transformation in Solid Solutions of Magnesium-cadmium Alloys. By I. I. Korniloff.

Segregation in Solid Solution Alloy Single Crystals. By Arthur Phillips and R. M. Brick.

Diffusion of Copper and Magnesium Into Aluminum. By R. M. Brick and Arthur Phillips.

Thursday Evening

Properties of Photographic Materials. (Talk following Annual Dinner.) By Walter Clark.

Metal Congress and Exposition

The 1937 Metal Congress and Exposition will be held October 18-22, in the Atlantic City Auditorium, Atlantic City, N. J. This Congress will be as usual sponsored by the American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio, of which **W. H. Eisenman** is Managing Director.

First International Electro-Deposition Conference

Organized by the

Electrodepositors' Technical Society

Northampton Polytechnic Institute,

St. John's St., London, E. C. 1, England

The First International Conference on Electrodeposition, organized by the Electrodepositors' Technical Society, will be held in London on the 3rd and 4th March, 1937.

British Industries Club

British Industries House,

Marble Arch, W. 1

The Management Committee have offered special facilities during the Conference. English members may become temporary members of the Club for a period not exceeding one month at a subscription of 5s. Temporary honorary membership of the Club is offered to foreign delegates for a period not exceeding five days.

In each case application for temporary membership should be made to the Conference Secretary.

Provisional Programme

Wednesday, 3rd March

12:15 p.m.: The Right Hon. Lord Melchett will open the Conference at British Industries House, Marble Arch, W. 1.

1 p.m.: Luncheon.

First Session: 2:30 p.m.-5 p.m. **Electrodeposition Practice Abroad.**

Second Session: 7:30 p.m.-10 p.m. **Electrodeposition of Base Metals.**

Thursday, 4th March

Third Session: 10 a.m.-12.30 p.m. **The Properties of Electrodeposits.**

Fourth Session: 2:30 p.m.-5 p.m. **Electrodeposition of Precious Metals.**

7:30 p.m. to 8 p.m.—Reception, Dinner and Dance at the Criterion Restaurant, Piccadilly Circus, W. 1. Dancing until 2 a.m.

Guests will be received by the President of the Electrodepositors' Technical Society.

PROVISIONAL LIST OF PAPERS TO BE PRESENTED AT THE CONFERENCE

Title	Author
Nickel Plating in France	M. Ballay (Fr.)
Degreasing with Alkali Cyanides	A. Chaybany (Fr.)
Anomalies in the Microstructure of Electro-Deposited Metals and their Influence on the Mechanical Properties	Michael Cymboliste (Fr.)
British Electroplating Practice	E. J. Dobbs (Br.)
Studies in Evaluating the Brightness of Electroplating	Dr. B. Egeberg (U.S.A.)
The Theory of Cathodic Deposits from Complex Salt Solutions	Prof. Ing. Dr. Techn. A. Glazunov (Czechoslovakia)
Zinc Plating	Dr. A. Kenneth Graham (U.S.A.)
American Electroplating Practice	George B. Hogaboom (U.S.A.)
Methods of Producing Adherent Deposits on Nickel and Chromium	A. W. Hothersall and G. E. Gardam (Br.)

Industrial Electrodeposition of Zinc and Cadmium and Laboratory Investigations of these Processes in U.S.S.R.	Prof. Dr. N. Isgarisheff (U.S.S.R.)
Comparative Properties of Metallurgical Surfaces Polished by Mechanical and Electrolytic Processes	M. P. A. Jacquet (Fr.)
The Application of Electrical Polishing to the Study of Metal Deposits	M. P. A. Jacquet (Fr.)
Modern Electroplating Machinery	Dr. John Kronsbein (Br.)
Recent Developments in the Electrodeposition of Tin	D. J. Macnaughtan (Br.)
The Crystal Structure of Copper Deposited from Cyanide Solutions	Prof. Arthur Phillips (U.S.A.) and W. R. Meyer (U.S.A.)
Optical Research of Thin Layers	Prof. L. S. Ornstein (Holland)
Modern Developments in the Electrodeposition of Gold	H. W. J. Pope (Br.)
Contribution to the Study of the Throwing Power of Electrolytic Baths	Prof. Albert Portevin (Fr.)
Chromium Plating from Non-Chromic Acid Solutions with Chromium Anodes	Prof. Dr. Ing. Max. Schlotter (Ger.)
Deposition of Platinum Group Metals	Dr. Carl Schumpelt (U.S.A.)
History, Development and Application of Cadmium for Electrodeposition	Gustaf Soderberg (U.S.A.)
German Electroplating Practice	Dr. Richard Springer (Ger.)
Zinc Plating of Strip—Standard Methods of Electrodeposition	Director A. M. Yulin (U.S.S.R.)
Copper Plating on Textiles	Dr. Kydriatzev (U.S.S.R.)
Technical Training for Electrodeposition in U.S.S.R.	Eng. Shviriaev (U.S.S.R.)
Resume of Silver Plating	Frank C. Mesle (U.S.A.)

Also papers by the following author (titles not yet received) :—
Prof. Jean Billiter (Fr.)

Boston Branch A.E.S.

c/o Andrew W. Garrett, 100 King St., Dorchester, Mass.

The Boston Branch of the American Electro-Platers' Society will hold its annual banquet on Saturday, March 6, 1937 at the Hotel Bradford.

The open meeting will start at 2 P.M. **Wm. Phillips** of General Motors will give an illustrated lecture on the Actual X-Ray of Plating Solutions. **Benjamin McGar** of the Chase Brass & Copper Co. and **Walter Meyer** of General Electric Co., will also present papers.

The banquet will be a splendid affair. The committee has arranged for a floor show, door prizes and dancing to one of the best orchestras obtainable.

Chicago Branch, American Electroplaters Society

Headquarters, c/o James Hanlon, 3004 N. Whipple St., Chicago, Ill.

The Annual Open Meeting and Banquet of the Chicago Branch of the A.E.S. was held on Saturday, January 16 at the Palmer House, Chicago, Ill. The educational session was held from 2 P.M. to 4:30 P.M. and a large audience profited by the valuable papers and discussions.

The banquet began at 7 P.M. with more than 400 members and guests at the tables. A large number of members and visitors from other branches of the society enjoyed a most pleasurable evening.

American Foundrymen's Association

222 W. Adams Street, Chicago, Ill.

ORGANIZATION CHANGE

As the first step in a program of broadening both its scope of activities and its responsibilities as a National Association of the Foundry Industry, the Executive Committee of the Board of Directors of the American Foundrymen's Association, at a meeting held in Chicago, December 4, elected **C. E. Hoyt**, for the past 18 years Executive Secretary-Treasurer, to the position of Executive Vice President in accordance with the recent revision of the By-Laws creating the office of Executive Vice President.

At the same meeting, **Dan M. Avey**, formerly Vice President and Director of the Penton Publishing Company and Editor of The Foundry, was elected Secretary-Treasurer, effective January 1, 1937.

In his new position, **Mr. Hoyt** will continue as the Executive officer of the Association, directing efforts toward broadening the field of service of the A. F. A.

International Exchange Paper Authors

The American Foundrymen's Association has selected **O. W. Ellis** and **W. Paul Eddy, Jr.** as exchange authors for the 1937 meeting of the British and French foundry associations respectively.

Dr. Ellis, Director of Metallurgical Research, Ontario Research Foundation, Toronto, will present the exchange paper before the Institute of British Foundrymen. Mr. Eddy has undertaken to prepare the paper for the annual meeting of the French Association, known as the Association Technique de Fonderie.

Ontario Chapter Meeting

Teaming up with the Ontario Chapter of American Society for Metals, the Canadian Section of the American Foundrymen's Association held its first general meeting of the year.

The Speaker of the evening was Harold J. Roast, Vice-President in Charge of Technical Operations, Canadian Bronze Co., Ltd., Montreal, Que.

Mr. Roast in his very scholarly style delivered a very interesting and enlightening talk on "Problems in Bronze". With lantern slides, patterns and sample castings, gates and risers he proceeded to tell of some of the heartaches and headaches of the Bronze Foundry and then in a very convincing manner to show some of the cures. He progressively took his interested audience through the stages of gating, risers, metal melting and mixing. Then proceeded to picture the point of view of the foundryman, designer, patternmaker, customer and salesman.

The executive of the Canadian Section of A.F.A. was represented in person by the Chairman—**L. L. Anthes**; Vice-Chairman—**Harold J. Roast**; Sec'y. Treas.—**Joseph Sully**; Directors—Prof. **O. W Ellis**; **A. G. Storrie**; **John T. Hepburn.**

Birmingham Meeting

Birmingham Chapter, American Foundrymen's Association, will meet February 25 and 26, together with the Birmingham section of the American Society of Mechanical Engineers.

The program will include the following papers:

Reclaiming, Conditioning and Handling Foundry Sand by Lester B. Knight, Jr., National Engineering Co., Chicago.

Sand Handling in Birmingham Foundries. General discussion.

Safety and Hygiene in the Foundry by E. O. Jones, director, Safety and Hygiene Section, A.F.A.

Prize To Stimulate Safety in Foundries

The American Foundrymen's Association announces that the 1937 A.F.A Obermayer Prize will be awarded to person submitting the best idea or device for safety or health protection, or idea which could be used to stimulate interest in safety of foundry or pattern shop workers. Two awards will be made, a first prize of $50.00, and a second prize of $25.00.

Contestants for the prizes will be limited to foremen, journeymen, apprentices or shop workers in a foundry, or to some department of a plant operated

in connection with a foundry or pattern shop, and must be either meembers of the A.F.A. or employed by a firm holding membership.

Anyone desiring to submit an entry for the 1937 contest should communicate with the secretary of the American Foundrymen's Association, 222 West Adams Street, Chicago, Illinois.

Connecticut Non-Ferrous Foundrymen's Association

Secretary Louis G. Tarantino, 523 West Taft Avenue, Bridgeport, Conn.

The meeting of Dec. 15th 1936 was held at the Hotel Duncan in New Haven. It was addressed by Harry W. Dietert of the Harry W. Dietert Co., of Detroit, Mich., who spoke to us on "Sand Control" giving numerous suggestions for a scrap reduction program and handling molding sand as well as the importance of controlling moisture content. He advised a daily permeability and green strength test and a weekly dry strength test. A very large attendance was present.

All officers were re-elected for 1937:

President—T. Joseph Judge, of Jenkins Bros. Co., Bridgeport, Conn.

Vice-President—H. A. Phelps, Phelps Foundry Co., Ansonia, Conn.

Treasurer—D. Wesley Case, Belknap Mfg. Co., Bridgeport, Conn.

Secretary—Louis G. Tarantino, 523 West Taft Ave., Bridgeport, Conn.

Technical Sec'y. — Harold King, Jenkins Bros. Co., Bridgeport, Conn.

The next meeting was held at same place on Tuesday, Jan. 19th, with dinner at 6:30 P. M. Round Table Discussions were held on "Manganese Bronze and Gun Metal" led by S. W. Chappell of Electric Boat Co., Groton, Ct.; "Valve Bronzes" led by David Tamor, Reading Pratt & Cady Co., Hartford; "Nickel Alloys" led by Ernest Stone, Consolidated Ashcroft Hancock Co., Bridgeport.

Foundry Equipment Manufacturers

1213 W. 3rd St., Cleveland, Ohio

A varied list of interesting and timely topics were set up for discussion by members of the Foundry Equipment Manufacturers' Association, Inc., when they assembled in Cleveland Hotel, Cleveland, Ohio, for their annual meeting on Tuesday, February 2nd, 1937.

Four standing committees submitted their reports to the Equipment Manufacturers, namely: Credit Interchange, Finance, Statistical, and Membership.

In line with the tendency of the times, the field of customer relations and service was carefully explored. Equal attention was given to methods for increasing sales without substantially increasing the ratio of sales expense.

Bronze Foundrymen Discuss Production Procedure

The Northern New Jersey Non-Ferrous Founders Association discussed modern foundry practice at their January 14th meeting. Their guest speaker was D. M. Curry, of the research and development staff of the International Nickel Company, 67 Wall St., New York.

Through technical development, non-ferrous foundrymen are keeping pace with the march of industry towards greater precision in production methods, with consequent improvement in quality of products. Dependence on individual skill is giving way to organized foundry control comparable to that employed in other branches of industry for successful mass production.

An important factor in improving non-ferrous foundry production is the increasingly widespread purchase of molding sands in accordance with specifications laid down by the Committee for Molding Sand Research of the American Foundrymen's Association. Foundry rejections are further minimized by purchasing only scrap of known composition and origin.

The wider application of the alloying principle has made it possible for the buyer of castings to specify properties of strength, toughness, hardness, and pressure tightness much superior to those formerly obtainable. Nickel bronzes containing between ½% to 3% nickel are used throughout industry for bearings, gears, valves etc., where their improved mechanical properties are useful. Reduction in cost effected by the replacement of a portion of the tin by an equivalent percentage of nickel is sometimes an additional consideration in their utilization.

When modern architecture broke away from traditional construction details, a need arose for decorative metals that are most expressive of fresh and bold conception. The nickel silvers were found to be ideally suited for use as trim, hardware and plumbing fittings. Their silvery lustre and easily cleaned surface, without coating to wear off, has stimulated their increased use by the architect. A large part of the production of the nickel silvers is in casting form. The foundry procedure necessary for their production were discussed.

Mr. Curry illustrated recent developments in the non-ferrous casting field by means of lantern slides. The meeting was held at the Essex House, Newark, N. J.

American Society for Testing Materials

260 South Broad Street Philadelphia, Pa.

Two technical symposiums, one on lubricants and the other on corrosion testing, are to be the features of the 1937 A.S.T.M. Regional Meeting to be held at the Palmer House, Chicago, on Tuesday and Wednesday, March 2 and 3. The Symposium on Corrosion Testing is scheduled for Tuesday evening, while the Symposium on lubricants will involve two sessions, Wednesday morning and afternoon.

The Regional Meeting is being held during A.S.T.M. Committee Week when some 100 meetings of the Society's committees will be held. At their meetings, the committees will review their research programs and discuss existing specifications and tests and consider new standards which are in course of development.

Symposium on Corrosion Testing

For some time there has been discussion in A.S.T.M. Committees A-5 on Corrosion of Iron and Steel and B-3 on Corrosion of Non-Ferrous Metals and Alloys on the matter of standardization of methods of corrosion testing. This discussion led to the appointment of a joint committee consisting of Dr. F. N. Speller, National Tube Co. and L. W. Hopkins, American Chain Co., representing Committee A-5; and R. J. McKay, The International Nickel Co., Inc., and C. L. Hippensteel, Bell Telephone Labs., Inc., representing Committee B-3. Dr. Speller is serving as chairman of this joint committee. After consideration of the various problems, the committee concluded that an excellent preliminary step would be the preparation of a detailed technical paper or a symposium covering all important phases of corrosion testing including tests in the laboratory and in service. A symposium on Corrosion Testing to feature the 1937 Regional Meeting is the result of the committee's considerations.

The program for this Symposium will comprise the following papers:

1. **Principles of Corrosion Mechanism and Testing—R. B. Mears,** Aluminum Company of America and **C. W. Borgmann,** National Tube Co.
2. **Atmospheric Testing—H. S. Rawdon,** National Bureau of Standards.
3. **Salt Spray Testing—E. H. Dix, Jr.,** Aluminum Company of America.
4. **Intermittent Immersion Testing—D. K. Crampton,** Chase Brass and Copper Company, Inc.
5. **Total Immersion Testing—R. J. McKay, W. A. Wesley,** and **F. L. La Que,** The International Nickel Co.
6. **Soil Corrosion Testing—K. H. Logan, I. A. Dennison** and **Scott Ewing,** National Bureau of Standards.

Written discussion of the papers will be invited by the committee in charge from various technologists who have made a study of special phases of the respective problems.

It is planned to hold the session in which the papers comprising the Symposium on Corrossion Testing will be presented on Tuesday evening, March 2.

General arrangements for the Chicago meetings will be in charge of the Chicago District Committee headed by **W. A. Straw,** Western Electric Co., with **C. E. Ambelang,** Public Service Co. of Northern Illinois, secretary. **D. L. Colwell,** Stewart Die Casting Corp., is chairman of the subcommittee on meetings and programs and **A. M. Steever,** Columbia Tool Steel Co., is chairman of the subcommittee on publicity and entertainment. The commit-

tee is planning to hold the Regional Meeting Dinner at 6:30 p.m. on Wednesday following the afternoon session of the Lubricants Symposium.

All engineers and others interested in the subjects to be discussed at the Regional Meeting sessions are cordially invited to attend.

American Society of Mechanical Engineers

29 W. 39th St., New York

American Society of Mechanical Engineers held, in connection with their annual meeting, in New York, November 30 to December 4, 1936, a symposium on corrosion. Eight papers composed the program, the general subject being **Corrosion Resistant Metals in the Design of Machinery and Equipment.** The papers presented were the following:

Introduction to Corrosion Resistant Metals by Dr. F. N. Speller, Director of Metallurgy and Research, National Tube Co., Pittsburgh.

Aluminum and Its Alloys by E. H. Dix, Jr. and R. B. Mears, Aluminum Research Laboratories, New Kensington, Pa.

The Construction and Use of Lead Equipment in the Chemical Industry by George O. Hiers, National Lead Co., New York.

Zinc in the Chemical Industries by E. A. Anderson, N. J. Zinc Co., Palmerton, Pa.

Cast Iron in Chemical Equipment by Dr. H. L. Maxwell, chief metallurgist, E. I. du Pont de Nemours & Co., Wilmington, Dela.

Copper and Copper Base Alloys by Dr. R. A. Wilkins, Director of Research, Revere Copper & Brass, Inc., Rome, N. Y.

Corrision Resistant Steel by J. H. Critchett, vice-president, Union Carbide and Carbon Research Laboratories, N. Y.

Nickel and Nickel Base Alloys by F. L. Laque, metallurgist, research and development department, International Nickel Co., N. Y.

Porcelain Enamel Institute

612 N. Michigan Ave., Chicago, Ill

The first Enamelers Round Table Conference to be sponsored by the Porcelain Enamel Institute, will be held next May at the University of Illinois, Urbana, Ill. The conference, according to preliminary plans, will be a three-day affair.

Plans for the conference are in charge of **F. E. Hodek, Jr.,** of the **General Porcelain Enameling & Mfg. Co.,** 4103 W. Parker Ave., Chicago, Ill.

Oil Burner Institute

30 Rockefeller Plaza, New York

The National Oil Burning and Air Conditioning Exposition will be held in Philadelphia, March 15 to 19, 1937, according to a report from **G. Harvey Porter,** Managing Director of the Oil Burner Institute and also of the Exposition Committee. Displays will feature the newest oil burner, distillate and air conditioning equipment produced by leading manufacturers for domestic, commercial and industrial application. Twenty-five manufacturers have already signed committments for over 40 per cent of the available booths.

Waste Material Dealers

Times Bldg., New York

The 1936 Convention of the National Association of Waste Material Dealers, Inc., will be held in Chicago, March 15 to 17 inclusive, at the Sherman Hotel.

An unusual innovation at this convention will be its operation along the lines of a well equipped club with the exclusive use of one of the large ballrooms of the hotel. Plans are afoot now for entertainment, not only for the members who attend but the ladies as well.

Louis Lippa of the Apex Smelting Co., Chicago, will be chairman of the Convention and Banquet Committee.

Jewelers Board of Trade

413 Turk's Head Bldg., Providence, R. I.

The Annual Meeting of the members of the Manufacturing Jewelers Board of Trade now using the style of the Jewelers Board of Trade, was held on Friday, January 22, 1937 at 12:00 o'clock, noon, at the offices of the association, 413 Turk's Head Bldg., Providence, R. I.

Frederick A. Ballou Jr., president, presided and made an interesting address. The reports of **Horace M. Peck,** secretary and treasurer were submitted. New officers and directors were elected for the coming year.

Personals

C. E. Hoyt

Charles Edgar Hoyt, recently elected Executive Vice President of the American Foundrymen's Association comes from a family of foundrymen, his father and three uncles having learned the molders trade in the days when a seven-year apprenticeship was required. During vacations, he worked in the foundry and, on finishing school, was associated for a time with his father in operating a jobbing and machine shop.

He then accepted a position with Michigan State College, East Lansing, Mich., in charge of pattern shop and foundry work. He held this position for three and a half years, resigning to accept a position on the engineering faculty of Lewis Institute, Chicago.

On locating in Chicago, Mr. Hoyt took an active part in association work, first as a member of the Western Foundrymen's Association, then as Secretary-Treasurer of the Chicago Foundry Foremen's Association. He later was elected Secretary-Treasurer of the Associated Foundry Foremen of America. As Secretary of the Chicago Association, Mr. Hoyt staged two conventions and exhibits at Lewis Institute which attracted the attention of members of the Foundry Supply Association resulting in his election as Secretary and Manager of Exhibits of this Association and its successor, the Foundry and Machine Exhibition Company.

C. E. HOYT

When the A. F. A. was incorporated in 1916, Mr. Hoyt was one of the signers of the application for a charter and was elected a director, in which capacity he served for several years. At the time of its incorporation, A. F. A. also took over the exhibition of foundry equipment and supplies, and Mr. Hoyt was elected manager of exhibits. Mr. Hoyt has continued in that capacity since that time, and will retain this position under the new set-up of the organization.

When the Association established a war service office in 1917 in Washington in response to a government request, Mr. Hoyt was placed in charge, resigning from the faculty of Lewis Institute, which position he had held during these years of association activities.

At the 1918 convention, he was elected secretary-treasurer of A. F. A., succeeding A. O. Backert who resigned to accept the presidency.

In 1926 Mr. Hoyt was made executive secretary-treasurer which position he held until his recent election to the executive vice-presidency.

James T. Gow has been appointed research metallurgist of the Battelle Memorial Institute, Columbus, Ohio.

W. R. Meyer, electrochemist, General Electric Co., Bridgeport, Conn., will attend the International Symposium of the Electrodepositors' Technical Society,

which will be held in London, during the first week in March. He will present a paper entitled, "Crystal Structure of Copper Electrodeposits" written by Arthur Phillips, Professor of Metallurgy at Yale University, and himself.

Arthur Jelinek, vice-president and treasurer of Arthur Seligman and Co., 30 Rockefeller Plaza, New York, sole distributors for the British Aluminium Co. in the United States, has joined the organization of the Reynolds Metals Co., 19 Rector St., New York, in an executive capacity.

Earl C. Hughes, assistant sales manager of Norton Co., Worcester, Mass., resigned recently to affiliate himself with the Bay State Abrasive Products Co., Westboro, Mass., as secretary. Mr. Hughes had been with the Norton Co. for eighteen years in various sales capacities.

Clyde E. Williams, Director, **Battelle Memorial Institute,** Columbus, Ohio, has announced the appointments of **Dr. C. A. Barnes, J. M. Pilcher** and **Tom Barlow** to the technical staff. **Mr. Pilcher** and **Dr. Barnes** have been assigned to the Fuels Division and **Mr. Barlow** to the Division of Process Metallurgy at the Institute.

Dr. Foster Dee Snell resigned as Honorary Secretary of the American Section of the Society of Chemical Industry at the Perkin Medal meeting held at The Chemists' Club, New York, in January. Dr. Snell took over the duties of this office on March 20, 1925 and has ably performed those duties for over 10 years. He was secretary at the time when the Society visited this country in 1928 to hold its annual meeting. During the following year **Dr. Arthur D. Little** was president of the Society. **Cyril S. Kimball** has been elected to succeed Dr. Snell in the office of Honorary Secretary of the American Section.

Willis Burns, manager, **International Smelting & Refining Co.,** Raritan Copper Works Division for the past 10 years has found it necessary, due to ill health to resign his position, and has been retired by the Anaconda Copper Co. **L. W. Kemp** for many years associated with **Anaconda Copper Mining Co.** in the management of their various plants has been appointed to position of manager to succeed **Mr. Burns. Mr. Kemp** comes here from the **Chile Copper Co.,** where he has filled position of assistant general manager of that company's properties located at Chuquicamata, Chile for the past 15 years.

Leslie L. Andrus, assistant sales manager of The American Foundry Equipment Co., Mishawaka, Indiana, for the past two years, has been appointed general sales manager in charge of all sales, service and advertising, according to an announcement by O. A. Pfaff, Vice President and General Manager.

Obituaries

John F. Harman

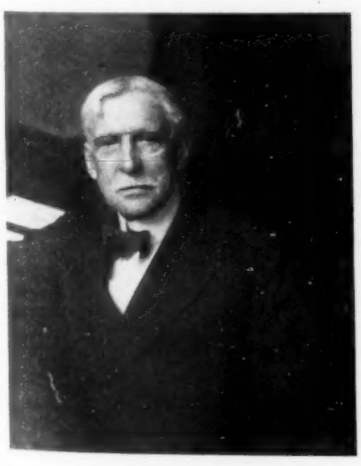
John F. Harman whose death on November 25, 1936, in his 93rd year was noted in our December issue, was a member of the Board of Directors of Handy & Harman, 82 Fulton St., New York, the internationally known precious metal house established in 1867.

Upon his retirement the Board of Directors of Handy & Harman adopted the following minute memorializing Mr. Harman's unique career:

"The meeting of this Board today is of particular significance because of the fact that it marks the termination of sixty-four years of active participation in the management of this business by its senior representative, John F. Harman.

"In 1867 Mr. Harman, then a youth of twenty-three, became associated with the organization which nineteen years later adopted his name under the partnership title of Handy & Harman. Upon incorporation in 1905, Mr. Harman was elected Vice-President, and has since held the offices of Vice-Chairman and Chairman of the Board of Directors.

"Few men are granted the bodily and mental vigor to continue in business for such a span of years, and when those sixty-four years have been devoted to the interests of one concern alone, and crowned with success, it is indeed a remarkable career."



JOHN F. HARMAN

Mr. Harman was born on May 1, 1844 in the Shenandoah Valley, Virginia, graduated from Washington and Jefferson College in 1865, and thereupon came to New York City to take a position as clerk in the specie firm of his uncle, Jacob Stoll Cronise. Shortly thereafter he entered the employ of Peter Hayden, dealer in bullion, and the acquisition of this business by Parker Handy marked the commencement of Mr. Harman's business association with three generations of the Handy family. Mr. Handy senior was succeeded by his son, the late Parker Douglas Handy, who was President of Handy & Harman from its incorporation until 1927, at which time the third generation assumed the presidency of the company in the person of Cortlandt W. Handy.

As a young man in New York City, Mr. Harman served as a deacon in the old Madison Square Presbyterian Church, and during his residence in Plainfield he belonged to the Crescent Avenue Church. His clubs were the Plainfield Country Club and the Down Town Association of New York.

In 1874, Mr. Harman married Miss Amelia Gray of New York City and she lived to celebrate with him their golden wedding anniversary. Mr. Harman is survived by two sons, Bryant G. and W. Gray and by two daughters, Elsie and Helen.

Professor William Campbell

William Campbell, professor of metallurgy, Columbia University, New York, died of a heart attack December 16th at his home, 39 Claremont Avenue, New York. He was sixty years old.

Professor Campbell was born in Gateshead-on-Tyne, England. He came to Columbia University in 1902 as a Fellow holding degrees from King's College and Durham University, London. He became an instructor in 1904, adjunct professor 1907, associate professor in 1912, full professor in 1914 and in 1924 he was appointed the first Howe Professor of Metallurgy.

During the World War, Professor Campbell held the rank of Lieutenant Commander in the Naval Reserve. He held the rank of Commander from 1919 to 1929. He was on the Advisory Committee of the U. S. Bureau of Standards and also of the National Research Council.

Professor Campbell edited a number of scientific journals in metallurgy and metallography. He was the recipient in 1903 of the Saville Shaw Medal of the British Society of the Chemical Industry and in 1905, of the scholarship of the Iron and Steel Institute. He was a member of a number of American and British Societies and fraternities.

Dr. Campbell left virtually his whole estate to Columbia University.

Charles D. Cook

Charles D. Cook died recently of pneumonia, aged 64. He was president of Cook, Dunbar, Smith Co., manufacturing jewelers, Providence, R. I.

Mr. Cook was born in Woonsocket, R. I., June 19, 1872, a son of the late Darwin M. and Olive Place Cook. A graduate of Worcester Academy, he lived in Providence 40 years. In 1906 he became associated with Clarence W. Dunbar and Robert O. Smith in the firm of Cook, Dunbar and Smith, makers of rolled gold plate, seamless wire and tubing. Mr. Cook was a member of Harmony Lodge, Providence Royal Arch Chapter, Knights Templar, Palestine Temple and the R. I. Consistory of 32nd degree Masons. He held memberships in the R. I. Country Club,

Manufacturing Jewelers' and Silversmiths' Association, Rolled Gold Platers' Association, Sons of the American Revolution, Mayflower Society, Sons of Colonial Wars and the R. I. Historical Association. Collector since childhood, he possessed row upon row of old weapons.

Carl Frank

Carl Frank, 60, manufacturing jeweler died January 14, at the home of his sister Mrs. Wm. H. Froeligh, 1100 Green St., Utica, N. Y., after a brief illness.

Mr. Frank was born in Utica Jan. 2, 1877, the son of the late William and Anna Darting Frank. He was educated in the public schools and as a boy he worked in Young's Bakery and in the Blaiser Polishing Works. In 1890 he went to work for Chas. H. Broadbent and learned the trade of manufacturing jeweler and diamond setter. In 1902 he established himself in the same line of business installing a forge, drawbench and other pieces of apparatus for working old gold and silver. He did work for dealers in jewelry not only in Utica but in Central and Northern New York.

Bartholt H. Hubbert

Bartholt H. Hubbert, president of B. H. Hubbert and Son, Baltimore, Md., died recently at his home, 3601 E. Pratt St., Baltimore.

Born in Budapest, Hungary, in 1871, Mr. Hubbert came to the United States in 1892, and as a coppersmith joined his brother, Adolph Hubbert, then working for the late Thomas A. Edison, in Schenectady, N. Y. He was a shipyard worker during the Spanish-American War, and during the World War was custodian for the Federal Government of all copper entering and leaving Baltimore.

His survivors include a son, Jacob Hubbert, seven daughters, Mrs. Elsie Shipley, Mrs. Marie Joyce, Mrs. Rose Wiseman, Mrs. Ruth Fleming, Mrs. Selma Pardo and Misses Pearl and Eleanor Hubbert, in addition to seven grandchildren.

Charles A. Bodman

Charles A. Bodman, aged 57, manager of Magnus Metal Company for seventeen years, died recently at his home, 1434 E. Louisiana Ave., Denver, Colo. after being in poor health for nearly a year.

Mr. Bodman was born in Chicago. As a young man he was engaged in the railroad, steel and metal industries, and seventeen years ago was sent to Denver to manage his company's plant here. He was active in Denver civic affairs, was a member of the chamber of commerce and the Lakewood Country Club.

Mr. Bodman is survived by his widow, Mrs. Isabel Bodman; two daughters, Mrs. Frank Begley and Mrs. Kenneth McGraw, both of Denver and a sister. Mrs. E. C. Hoyng of Chicago.

William Frankham

William Frankham, founder of the Frankham Brass & Bronze Works of Canton, Ohio, died on Friday, November 20, 1936 of a heart attack. He was 81 years old.

Mr. Frankham who had been retired for the last 16 years was born in Birmingham, England, where he grew up in the brass and bronze business. He came to America at the age of 18, and after beginning as a foundry worker, advanced rapidly until he became the manager of a foundry in Philadelphia. In that city he attended and graduated from the Franklin Institute. He came to Canton in 1888 to take charge of the McLain Co., and three years later established his own business under the name Frankham Brass & Bronze Works, which upon his retirement sixteen years ago, became known as the Frankham Brass & Bronze Co.

Hugh R. Grable

Hugh R Grable, 46 of 326-22nd St. N. W., Canton, Ohio, president and general manager of United Metal Products Co., for 19 years, died recently following and operation.

Mr. Grable was born in Canton and had lived there all his life. He had served as director and board member of Home Savings & Loan Co. and was a member of St. Peter's Catholic Church, Congress Lake Club, Canton Club and the Ohio Society of New York.

Surviving Mr. Grable are his widow, Mrs. Daisy Myers Grable; two sons, Hugh R. Grable Jr., a student at Kent University, and Ned S. Grable; his father, Elmer S. Grable, St. Petersburg, Fla., former superintendent of Stark County Home; a brother, Arthur A. Grable of Canton and two sisters, Mrs. John W. Ebie and Mrs. Edgar Hoff, both of Canton.

Frank C. Nichols

Frank C. Nichols, 68, died recently after an illness of several months, at his home in West Hartford, Conn. He was for nearly 30 years vice-president of Colt's Patent Fire Arms Manufacturing Co.

Mr. Nichols was a native of Oswego, N. Y. He was born September 14, 1868, the son of Francis M. and Sophie Shepard Nichols, and entered the service of Colt's in 1901 as salesman. Mr. Nichols was made sales manager in 1905, and became vice-president on February 14, 1907. In addition to his executive duties he directed the export business of the company.

Ralph C. Rose

Ralph C. Rose, 45, manager of Muloch Foundry and Machine Co., Kaukauna, Wisc., died December 9th. Before joining the firm about two years ago, he was for several years sales manager of Stroh Die Casting Co., Milwaukee, Wisc.

Henry O. Van Eweyk

Henry O. Van Eweyk, 68, founder and president of Milwaukee Brass Mfg. Co., Milwaukee, Wisc., died in that city December 6th.

David M. Ireland

David M. Ireland, prominent in the brass industry in this area for many years, died at his home, 165 East Grand Boulevard, on Dec. 6. Services were held on the following Thursday, with burial at Waterbury, Conn.—**F. J. H.**

P. J. Sheehan

P. J. Sheehan, first vice-president of the American Electro-Platers' Society, died suddenly on Saturday, January 9, at 55 years of age. An extended biography of Mr. Sheehan will appear in an early issue of **Metal Industry.**

Carl Henry Leis

Carl Henry Leis, chief engineer and factory manager of Johnson Bronze Co., New Castle, Pa., died at his home in that city on Nov. 15, 1936, aged 45 years. Mr. Leis was born in Germany and came to this country in 1917, and had been associated with the Johnson company since 1927.

Frank Maujean

Frank Maujean who was known throughout the United States to the foundry trade, having been with the Monarch Engineering & Mfg. Co., Baltimore, Md., for many years, passed away at his home in Newport, Ky., November 24, 1936.

Andrew A. MacLean

Andrew A. MacLean, aged 55, president of Fisher Brass, Inc., Marysville, Ohio, died in Marysville, November 1, 1936.

Metal Developments

Early in December the United States Navy went into the market for 2,600,000 pounds of copper. The metal had to be bought under the new Walsh-Healey Government Control Act, which provides that concerns making contracts with the Government of more than $10,000 must pay prevailing wages as determined by the Secretary of Labor, must establish a 40-hour maximum work week and employ no child labor.

No bids appeared.

The **National Lead Co.,** 115 Broadway, New York, has revised its existing pension plan to provide retirement incomes independent of and in addition to the old-age benefits payable in the

future by the Government, under the Federal Social Security Act.

Employees on hourly and piece work rate at the Pangborn Corporation, Hagerstown, Md., will receive a pay increase of 10% effective December 30th; the company also announces a Christmas bonus payable December 17th and the adoption of a standard 45 hour week effective December 30th.

The "marsh buggy," an amphibious conveyance, is being used by the geophysicists of the Gulf Oil Corporation in the swamps of Louisiana, in prospecting for oil. This marsh buggy has wheels with tires 10' in diameter, 33½" across, mounted on rims 66" in diameter. The wheels are made of sheet aluminum and are actually tanks of sufficient displacement to keep the vehicle afloat in deep water even if all tires were deflated.

American Bureau of Invention, General Motors Bldg., New York City, has been organized for the purpose of shortening the lag now existing between the conception of an idea and its commercial fruition. A permanent exhibition is planned for inventions, apparatus, materials and graphic presentations of facts and information for the benefit of manufacturers and others.

A news item from the General Electric Co., at Schenectady, N. Y., states that strips of two alloys, Copnic and Chromel, were recently welded together and rolled to a thickness of only six millionths of an inch. This is said to be the first time that two alloys welded together have been reduced to such a thin section by rolling.

The new trawler, Greyhound One, Greyhound Trawling Company, Boston, Mass., was recently launched. This trawler used nickel clad steel in the construction of the hold, a layer of solid nickel having been rolled on a heavier layer of carbon steel in such fashion as to form a permanent bond that can be destroyed only by grinding.

The **General Bronze Co.,** Long Island City, N. Y., recently designed and cast a nickel silver plaque commemorating the meeting more than a century ago between two victorious generals of the war for South American independence, "The Liberator" Simon Bolivar and Jose de San Martin, called "Protector of Peru." Nickel silver was selected for its durability and resistance to corrosion in the moist, hot climate of Guayaquil, located near the equator at sea level.

Arc Welding Foundation

The Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio, has established the **James F. Lincoln Arc Welding Foundation,** for scientific study, research and education in respect to the development of the arc welding industry. **Dr. E. E. Dreese,** chairman of the Department of Electrical Engineering of the Ohio State University, will be in charge of the principal direction of the Foundation's work.

Lead Industries Seal of Approval Licensees

As of January 1, 1937, the following manufacturers of lead plumbing goods were licensed to use the recently announced "Lead Industries' Seal of Approval" on lead pipe, traps and bends meeting the standards of the Lead Industries Association:

Alpha Metal & Rolling Mills, Inc., 365 Hudson Ave., Brooklyn, N. Y.
The Andrews Lead Co. Inc., 36 Greenpoint Ave., L. I. City, N. Y.
Baker Lead Mfg. Co,. Worcester, Mass.
Cambridge Smelting Co., Cambridge, Mass.
Crown Metal Co., 117 E. Washington St., Milwaukee, Wis.
The Eagle-Pilcher Lead Co., Temple Bar Bldg., Cincinnati, Ohio.
Federated Metals Division of American Smelting & Refining Co., 295 Madison Ave., N. Y.
Gardiner Metal Co., 2514 W. 48th Pl., Chicago, Ill.
Marks Lissberger & Son, Inc., 2301 Borden Ave., L. I. City, N. Y.
National Lead Co., 111 Broadway, N. Y.
Northwest Lead Co., 1742-4th Ave. S., Seattle, Wash.
Rochester Lead Works, Inc., 382 Exchange St., Rochester, N. Y.
White Metal Rolling & Stamping Corp., 84 Moultrie St., Brooklyn, N. Y.

Business Items-Verified

Organization changes in the **Western Electric Company,** 195 Broadway, New York, effective January 1, 1937 were announced. **Frederick B. Gleason,** General Commercial Manager of the Western Electric Company will retire. He will be succeeded by **Douglas F. G. Eliot,** who is at present Personnel Director of the Company. **Gustaf A. Johnson,** now in charge of the Company's Installation Department in the East, will take Mr. Eliot's place as Personnel Director. **David W. Reid,** General Accounting Superintendent of the Installation Department, will succeed Mr. Johnson as head of that Department's Eastern operations. **Beecher H. Clark** will assume the post vacated by Mr. Reid. **J. Kenneth Crosland,** General Commercial Accountant, becomes Assistant Comptroller.

Thomas J. Dillon, President, Edge Moor Iron Works, Edge Moor, Delaware, announces the appointment of **Russell T. Kernoll** as Chief Engineer of Welded Fabrication.

American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York, announce the acquisition of the business and plant of **Chas. H. Stone, Inc.,** of Charlotte, N. C. Its operations will be merged with those of Cyanamid's Southern District. The Charlotte District will be under the direction of **Paul F. Haddock,** Southern Sales Manager, and **Chas. H. Stone,** Charlotte District Production Manager. The Charlotte Office will be transferred to and the business of the Southern District conducted from 822 West Morehead Street, Charlotte, N. C. It is requested that all orders, inquiries and correspondence be directed to P. O. Box 1067. Telephone numbers, Charlotte 6129 and 3-4115; Long Distance 942 and 981. The Greensboro, N. C. warehouse will be continued at 125 Walker Avenue, and the Greenville, S. C. warehouse at 409 Westfield Street.

The **Roller-Smith Company,** 233 Broadway, New York, N. Y. announce the appointment of **H. A. Stanley** as their District Sales Agent in North and South Carolina. Mr. Stanley will make his headquarters at Charlotte, N. C.

The **Precision Scientific Company,** 1730-54 N. Springfield Avenue, Chicago, Illinois, announce that they are now the sole manufacturers of Freas and Thelco Constant Temperature Laboratory Equipment formerly built and sold by the **Freas Thermo-Electric Company** of Irvington, New Jersey, and Chicago, Illinois.

Atlas Powder Company, Wilmington, Del. announce the acquisition of "Revolite," formerly manufactured by the **Revolite Corporation,** a subsidiary of Johnson & Johnson, New Brunswick, New Jersey. The manufacture of "Revolite" will be moved to Stamford, Connecticut, where the business will be conducted by the Zapon Division, Atlas Powder Company. **M. J. Creighton,** General Manager of the Zapon Division, will direct the new enterprise. "Revolite" is the registered trade name of a fabric coated with a flexible Bakelite resinoid. Atlas is taking over Revolite personnel in both sales and manufacture. **Gustav Gurska** is General Sales Manager of Zapon Coated Fabrics. **William A. Michie,** who has been associated with the Revolite Corporation, will be in immediate charge of Revolite sales.

A. J. Wadhams, Vice President of The **International Nickel Co., Inc.,** 67 Wall St., New York, and Manager of the Development and Research Division, has announced several additions to the technical staff. **Charles H. Lindsley,** a physical chemist, will specialize in the application of physico-chemical methods to the study of corrosion phenomena. **Donald J. Reese,** a foundry engineer, will carry on research work on cast iron at the company's research laboratory. **Frederick G. Sefing,** formerly Assistant Professor of Metallurgy at Michigan State College, will also be employed on research work in cast iron at the Bayonne laboratory. **Richard F. Barnes, Jr.** will be available to industry at large for technical service on prob-

lems involved in the utilization of mill products such as Monel, Nickel and Inconel for applications requiring resistance to corrosion. **Carl Rolle** will be available to industry for consultation on mill product fabrication problems.

A new, strictly modern office building, to accommodate an office staff which has been literally forced out of its old quarters by expansion of factory operations of **Wolverine Tube Company,** has been started on ground immediately adjacent to the Wolverine Tube Company factory, 1411 Central Ave., Detroit, Mich.

C & S Casting & Plating Co. Inc., have been incorporated to manufacture metal castings; Lester Cohan, 40-17-22nd St., Long Island City, N. Y. The following departments are operated: casting shop, grinding, polishing and buffing, electroplating, lacquering.

Metal & Thermit Corp., 120 Broadway, New York, plan one-story addition to branch plant at So. San Francisco, Calif. Cost close to $75,000 with equipment.

Centre Brass Works, 207 Centre St., New York, have appointed Gus Adams, 1045-17th St., San Francisco, Pacific Coast representative for sale of their solid brass fire place furnishings. This firm operates the following departments: brass machine shop, polishing and buffing, lacquering.

Edward Carson, formerly with White Bros. Smelting Corp., is now located with the North American Smelting Co. Inc., Philadelphia, Pa., as a buyer.

Reliable Aluminum Ware Co., is now located at 1123 E. 63rd St., Los Angeles, Calif. This firm manufactures cast iron and cast aluminum hollow ware. The following departments are operated: aluminum foundry, grinding, polishing and buffing.

Fruehauf Trailer Co., Atlanta, Ga., have recently completed and are now located in building at 496 Courtland St. N. E.

Shroer Mfg. and Metal Stamping Co., Kansas City, Mo., will double its space shortly when it occupies the addition being built at 2221 Campbell St. This firm operates the following departments: brass machine shop, tool room, spinning, stamping, soldering, brazing, grinding, polishing and buffing, electroplating, lacquering, japanning and enameling. The main line consists of finished manufactured articles, where pressed metal parts are used.

Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich., held a conference of the regional sales managers at the Detroit office of the company, December 16 to 20th inclusive. Plans are being formulated for doubling the sale of degreasers, solvents and alkali cleaning compounds during the ensuing year.

Ampco Metal, Inc., 3834 W. Burnham St., Milwaukee, Wisc., announces the appointment of the Hampden Brass Co., Springfield, Mass., as eastern representative for the production of Ampco metal castings. Ampco Metal is a copper base alloy containing aluminum and iron with tensile strengths ranging from 55,000 to 100,000 pounds per sq. in. At the present time the following foundries have been licensed to pour Ampco metal castings: Hampden Brass Co., Springfield, Mass., E. A. Williams & Sons Inc., Jersey City, N. J., Wellman Bronze & Aluminum Co., Cleveland, Ohio, Commerce Pattern Fdy. & Mche. Co., Detroit, Mich., Atlas Brass Foundry, Inc., Los Angeles, Calif.

Metal Equipment Co., 2032 W. 105th St., Cleveland, Ohio, is now manufacturing a low-cost enamel finish welded-seam letter-size all-steel transfer case, which is said to be dust-proof, vermin-proof and fire resistant.

The **Lincoln Electric Company,** Cleveland, Ohio, announces that Robert Daniels has been placed in charge of the Chattanooga, Tennessee office of the Company located at 1015 Hanover Street. Mr. Daniels has been associated with the Company in sales work since April 1934.

Anchor Manufacturing Co., 164 Oliver St., Boston, Mass., manufacturers of metal stampings, electric wiring devices, etc., have leased space in former textile mill of Amoskeag Mfg. Co., Manchester, N. H., for plant, removing present works to new location and increasing capacity. Departments: tool room, stamping, metal spraying, grinding, japanning and enameling.

Phoell Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill., are erecting a two-story addition, 75 x 300 ft., for general offices, finished products and packing and shipping departments.

George E. De Tray and **Donald E. De Tray** have purchased the three-story building at 11606 Van Horn Rd. near Independence, Mo., for an expansion of their metal plating shop. Departments: metal spraying, polishing and buffing, electroplating and lacquering.

Titan Valve & Mfg. Co., manufacturers of thermostats and other products, 3205 Perkins Ave., Cleveland, Ohio, have acquired the **Noble Refining Co.** plant on Elk Avenue. The building, a two-story concrete and steel unit, 88 x 100 ft. in size, will provide the Titan company with about triple its present space. Departments: brass foundry, brass machine shop, tool room, grinding, soldering and tinning.

Coleman Lamp & Stove Co., 253 N. Mead St., Wichita, Kan., manufacturers of stoves, lamps and other electric domestic products, have let contract for two-family addition, 90 x 130 ft. to cost close to $60,000 with equipment. Departments: cutting up shop, stamping, soldering, brazing, tinning, grinding, polishing and buffing, lacquering, japanning.

Gar Wood Industries, Inc., Highland Park, Mich., manufacturers of mechanical equipment, machinery and parts, have begun erection of one-story addition, exclusively for road building machinery division, to cost close to $50,000 with equipment. **C. W. Wood** is plant manager. Departments: tool room, cutting-up shop, stamping, soldering, brazing, grinding, polishing and buffing, lacquering and enameling.

Metals Processing, Inc., Erie, Pa., have been granted a charter for application of protective and ornamental coatings. The firm, composed of **Otto G. Hitchcock, Carl H. Cooper, George L. Fuessler,** and **Herman Leonaz,** majority stock holder and manager, is capitalized at $10,000. Departments: zincing (galvanizing), tinning and sandblasting.

Condor Products, Inc., 315 Niagara St., Buffalo, N. Y., manufacturers of Scotch garters, braces and belts, have recently installed a complete finishing department to be used for processing metal articles to be used in connection with their products. Departments: tool room, cutting-up shop, stamping, metal spraying, polishing and buffing, lacquering departments.

William Rein has been appointed resident sales representative in the southern part of Florida for the Magnus Chemical Co., Garwood, N. J., manufacturers of cleaning materials, industrial soaps, sulfonated oils, emulsifying agents and metal working lubricants.

Bristol's Instrument Company, Ltd., London, England, celebrated its fourth year of manufacturing Bristol Instruments in England by moving into a new home located at Brent Crescent, North Circular Road, West Twyford. The move to larger quarters has been carried out under the direction of **G. H. Gaites,** Managing Director.

The Meriam Co., 1955 West 112th Street, Cleveland, Ohio, have now completed the extension to their gas and oil engine rebuilding plant. The new premises, which adjoin the old, are 100 ft. x 54 ft., thus enabling engines up to large sizes to be readily handled.

Hodes Zinc Manufacturing Co., manufacturers of automotive accessories, Fremont, Ohio, have purchased the **New York Bronze Sign Co.** of Toledo, Ohio. The latter concern, makers of advertising name plates, are being removed to the former Clauss Shear Company plant. **George W. Derry,** Toledo, and **W. E. Hausman,** Fremont, will be in charge of production. This firm operates the following departments: casting shop, metal spraying, grinding, polishing and buffing.

The partnership which has existed between **Charles H. Proctor** and **Herman Bond** under the name of the **Proctor and Bond Chemical Co.**, was dissolved on Nov. 15, 1936. The company will be hereafter known as the **Proctor Chemical Co.**, Clearwater, Fla. **Mr. Proctor** developed all the chemical products known to the public as Klean-Rite cleaners, Paradoe Spray, Insecticides, etc., and is sole owner of the titles to such products and their chemical compounds. Such products can only be purchased through the Proctor Chemical Co. or its direct representative, Norman D. Robinson, general sales manager.

Federated Metals Corp., was dissolved as of December 7, 1936, and the **American Smelting and Refining Co.**, at the close of business on that date took over its assets and business. The business heretofore conducted by the **Federated Metals Corp.**, will be conducted by the **American Smelting & Refining Co.**, under the following style: **Federated Metals Division, American Smelting & Refining Co.**

The **Apex Electrical & Mfg. Co.**, manufacturers of electrical household appliances, 1070 E. 152nd St., Cleveland, Ohio, have purchased the business of **Holland-Rieger Co.**, manufacturers of washers and ironers, Sandusky, Ohio. **C. G. Frantz** is president of the **Apex** company, and **S. S. Holland**, president of the **Holland** company will continue in charge of operations in Sandusky, while **Oscar Rieger** will retire from the firm. The following departments are operated: tool room, stamping, grinding, polishing and buffing, electroplating, lacquering and enameling.

Reliable Metal Spinning Corp., 335 Northern Ave., Indianapolis, Ind., have been incorporated (capital stock 100 shares having no par value) to manufacture sheet metal products, and to do all kinds of metal spinning. Incorporators are **George A. Danneker, Fred Drexler** and **Fred P. Irvine.**

Wm. Ball, Sr., Hope Manor, West Chester, Pa., has re-organized, former general shop having been destroyed by fire. The firm specializes in the manufacture of reproduction brasses for use on antique furniture. Departments: brass machine shop, spinning, grinding, polishing and buffing.

Master Electric Co., Dayton, Ohio, 100 Davis Ave., manufacturers of electric motors, electric fans and kindred products, have purchased 1½ acres, improved with buildings totalling approximately 70,000 sq. ft. of floor space. Company has liquidated its subsidiary, Pioneer Heat Regulator Corp., Dayton, Ohio, manufacturers of temperature control equipment, and henceforth will be known as the Pioneer Heat Regulator Division of Master Electric Company.

Guarantee Specialty Mfg. Co., 9 E. 96th St. & N. Y. Central R. R., Cleveland, Ohio, have selected property at Colliers, W. Va., for a new one-story blanking plant, totalling about 100,000 sq ft. floor space at a cost of close to $140,000 with equipment. The company manufactures metal stampings, hardware, etc.

Linderme Tube Co., manufacturers of copper and brass tubing, 1291 E. 53rd St., Cleveland, Ohio, have purchased a five-acre tract of land in suburban Euclid, Ohio, according to an announcement by company officials, who stated the land was acquired as a site for future factory.

Bowen Products Corp., Ecorse, Mich., plan to erect factory building here, one and two-stories to measure 440 x 240 ft. The company manufactures oil and grease cups, lubricators, sheet metal stampings. Main office and plant are located in Auburn, N. Y. This firm operates the following departments: tool room, stamping, grinding, polishing and buffing, electroplating.

The former **Benedict & Burnham Rolling Mill** on South Main St. between Washington Ave. & Jewelry St., Waterbury, Conn., will be discontinued within the year, according to a statement made recently by **Clark S. Judd**, vice-president of the **American Brass Co.** This operation will be consolidated with similar equipment at the north plant, the old Waterbury Brass Co. in the West End. Mr. Judd denied a report that the American Brass Co. was planning to build a new rolling mill. He stated they are abandoning one mill and putting an addition on the other.

Cutler-Hammer, Inc., manufacturers of Electric Control Apparatus, Milwaukee, Wis., announces the appointment of **T. D. Montgomery** as Manager of its Foreign Sales Division.

Foster D. Snell, Inc., 305 Washington Street, Brooklyn, New York, held their annual dinner on January 12, with 24 members of the organization present and 4 absent. Ray Hedman acted as toastmaster and introduced as speakers Leon V. Quigley, Dr. Foster Dee Snell and Cyril S. Kimball.

The **Halliwell** unit of **American Machine & Metals, Inc.**, 100 Sixth Ave., New York, manufacturer of hair dryers, permanent waving machines and other beauty parlor equipment, is being moved to East Moline, Ill. This move is part of a program of **American Machine & Metals, Inc.**, who are spending approximately $300,000 in expansion and enlargement, moving to E. Moline several of their manufacturing divisions or subsidiaries which were formerly located in Chicago, New York City, Troy, N. Y. and Philadelphia.

Progressive Iron & Metal Co., 81 W. Main St., New Britain, Conn., has been incorporated for $1,000. Edward Menus, president; Charles Segal, treasurer; Harold I. Koplowitz, secretary. They are in the market for a No. 2 shear, 1 bailing machine for skeleton steel to bundle from 80 to 100 pounds.

Logan Wood, vice president and general manager of **Gar Wood Industries, Inc.**, Detroit, Mich., has announced the appointment of **Ralph S. Jenkins** as the Company's new vice president in charge of all manufacturing.

The American Foundry Equipment Company, 408 South Byrkit Street, Mishawaka, Indiana, announced that a contract for building additions to their plant and engineering buildings has been awarded.

News From Metal Industry Correspondents

New England States

Waterbury, Conn.

January 25, 1937.

Employees of the **American Brass Co.**, **Scovill Mfg. Co.** and **Chase Brass & Copper Co.** were given another wage increase in December, averaging roughly, 5 per cent. An increase of about that amount was also given in September. The **Scovill Co.** directors in December also voted to give employees who have been with the company a year or more, a week's vacation with pay during the present year.

The **Plume & Atwood Mfg. Co.** gave its employees a wage increase of 5 per cent in December. This applies to 500 employees here and 400 in Thomaston.

The **American Brass Co.** plans to build a substantial addition to the rolling mill that was formerly a part of the old Waterbury Brass Co. on West Main Street. At the same time the rolling mill of the old Benedict & Burnham Mfg. Co. on South Main Street will be abandoned. This is a further move to consolidate operations of the three American Brass plants in this city. Most of the buildings of the former Holmes, Booth & Hayden plant on Bank Street have been torn down or vacated by the company within the last few years.

The **Waterbury Farrel Foundry & Machine Co.** is planning an addition, 85 by 130 feet, costing about $30,000. It will be of brick and the center will be one and a half stories high to provide room for a crane, and the remainder will be one story high.

John H. Goss, vice president of the **Scovill Mfg. Co.** is one of a number of national business leaders quoted by the Associated Press on a survey of the last

year and the outlook for next. He said:

"There could be no such record as 1936 has shown unless confidence had been tremendously restored. Ahead lie two dangers: that the government will not live up to its obligations under the mandate of the people but will throw up barriers halting the progress of production and that business management will become discouraged and not improve productive methods as they have in the past. A way must be found to encourage the limited number of competent leaders and keep them functioning. Government and industrial management must cooperate to give the people the social security they desire."

A cease and desist order was issued in December by the Federal Trade Commission against the **Waterbury Buckle Co.** and six other concerns manufacturing pin tickets for use in marking prices and stock numbers on garments offered for sale. The order prohibits them from entering into any agreement to fix prices for the sale of these tickets and from restricting competition. **Jerome LaVigne,** secretary of the company, explaining the order, said it is an aftermath of the NRA under which the pin manufacturers were urged by the government to get together to standardize prices. Since the NRA there has been no such combination or agreement, he said.—**W. R. B.**

Connecticut Notes

January 25, 1937.

BRIDGEPORT — The **Bridgeport Brass Co.** increased the wages of its 3,000 employees by about 7½ per cent. A previous 5 per cent increase was given in September.

C. K. Davis, president of the **Remington Arms Co.,** reports that while no military rifles of any kind are being produced or sold, the company has had a 200 per cent increase in the sale of hunting rifles and a corresponding increase in the sale of ammunition.

Harvey Hubbell, Inc., electrical manufacturers, gave a bonus amounting to one week's pay to all employees at Christmas.

NEW HAVEN—Winchester Arms Co. gave its 3,500 employees a wage increase amounting to 5½ per cent in December.

The business and assets of the **Crawford Oven Co.** of this city have been purchased by the **American Machine & Foundry Co.** of New Jersey.

MIDDLETOWN—Russell Mfg. Co. has the largest working force now that it has had since 1930. **President G. M. Williams** reports. However, because of stop orders received from the **General Motors Corp.** it is expected that 50 or more employees will have to be laid off and others put on short time.

Wilcox, Crittenden Co. paid its employees a bonus of one week's pay on Christmas.

TERRYVILLE—The 800 employees of the **Eagle Lock Co.,** who went out on a strike in the latter part of November, returned to work after a week under an agreement giving them an increase in wages of about 10 per cent. The employees have formed a union under the supervision of the C. I. O. The State Labor Department is making a survey of wages paid in similar establishments and if the rate is higher, the Eagle Lock Co., under the terms of the agreement, must grant another increase.

Charles W. Plub, secretary of the Eagle Lock Co., died at the age of 60 December 20. **Harry C. Clow** has been elected as his successor. He will continue as production manager, a position he has held for several years.

WINSTED—Increases in wages of from 5 to 10 per cent were given the employees of the **W. L. Gilbert Clock Co.** in December.

The **Dano Mfg. Co.,** manufacturer of electric coils had leased one of the buildings of the former **Strong Mfg. Co. Walter V. Davey,** president, and **Robert L. Noble,** treasurer, were associated with the former **Strand & Sweet Co.** and **Polymet Mfg. Co.**

BRISTOL—About 100 employees of the **New Departure Co.** have been laid off temporarily and the other 2,400 employees have been put on a 32-hour a week schedule as the result of stop orders received from the **General Motors Co.** About 200 employees of the Meriden plant of the company have been laid off. The working hours of the **Bristol Brass Corp.** have been cut from 10 to 8 for the same reason.

THOMASTON—Seth Thomas Clock Co. plans to build a four story addition of brick, steel and cement within the next few months. The marine division and the tower clock division of this town will be moved there as will the **Stromberg Electric Co.** of Chicago.

HARTFORD—The **Chance Vought Aircraft Co.** has received an order for 40 scouting bombers from the Navy.

WATERTOWN—Employees of the **Watertown Mfg. Co.** were given a pay increase amounting to 5 per cent on Dec. 18.

MILLDALE—The **Clark Bros. Belt Co.** on Dec. 26 paid its employees a bonus amounting to 7½ per cent of their earnings for the previous 13 weeks.

—**W. R. B.**

Providence, R. I.

January 25, 1937.

Howard C. Baker and **Norman D. Baker** have filed statement at City Hall that they are the owners of the refinery business at 91 Page Street, conducted under the name of **George M. Baker.**

The **Genser Manufacturing Company** at 45 Waldo Street is owned by **Max Genser** and **David Genser.**

The **Kenney Manufacturing Company** has purchased land and buildings on the north side of Arthur Street, Cranston.

Statement of ownership of the **I & W Manufacturing Company,** 144 Pine Street, has been filed at City Hall by **John Isabella** and **Edmund M. Wilson.**

The Acmer Automatic Screw Machine Products Company, 192 Benefit Street, Pawtucket, is owned by **Edna F. Blackard,** of 11 Hanover Street, Pawtucket.

Upon the petition of **Angelo Rossi,** the **T & R Jewelry Company Inc.,** 7 Eddy Street the Superior Court of Providence County has entered a decree dissolving the business as a corporation.

Novelcraft Inc. of Providence, has been incorporated under the laws of Rhode Island to deal in metal novelties etc., with an authorized capital consisting of 100 shares of common stock at no par value. The incorporators are: **Edmund Wexler, Joseph E. Adeson** and **Charles M. Robinson,** all of Providence.

The **Armbrust Chain Company,** occupying the entire fifth floor of the Irons & Russel building, 95 Chestnut Street, has announced the discontinuance of its manufacturing jewelry department but will devote its entire factory in future to the manufacture of machine-made chains for the manufacturing trade.

The January meeting of the **Metal Findings Association** was held on the 6th inst. at Narragansett Hotel, where, after the usual luncheon a discussion of topics pertinent to the industry was held.

The annual banquet of the **New England Manufacturing Jewelers' and Silversmiths' Association** will be held at the Providence-Biltmore Hotel on Saturday evening, February 13 at 6:30 p. m.

Laminated Metals Corporation has been incorporated under the laws of Rhode Island to manufacture metal ornaments, novelties and findings with an authorized capital consisting of 600 shares of common stock of no par value. The incorporators are: **Edson W. Sawyer, Harold B. Sawyer** and **G. Louvre Sawyer.** They are respectively vice president, assistant treasurer and salesman of the **Improved Seamless Wire Company.**

Carl Art Company, of Providence, has been incorporated under the laws of Rhode Island to manufacture and deal in jewelry and findings. Its authorized capital is $65,000 divided as follows: Class A $32,000 common, of 650 shares at $50 each and $32,000 Class B common 650 shares at $50 each. The incorporators are: **Stuart H. Tucker** and **Stanley H. Smith** of Providence and **Edward W. Lincoln** of Barrington, R. I.

The **American Brass Company** has removed from 131 Dorrance Street to its new building, corner of Chestnut and Elm Streets. **Paige A. Seaton** is the manager of the Providence branch which was established by the late **Phineas F. Parsons** in 1880.

The **Manchester Silver Company** has awarded the contract for the erection of a two story addition of brick to its plant, at Pavilion Avenue and Toner Street, to cost $14,000.

Matthew T. Dunn of 292 Massachusetts Avenue, has filed information with the City Clerk's office of ownership of **Dunn Brothers,** 139 Baker Street, manufacturing jewelers.

The **Mason Jewelry Company,** manufacturing jewelers at 38 Friendship Street, is owned by **Joseph Slavinsky,** of 103 Pratt Street, according to his statement filed at City Hall.

The **Concord Manufacturing Corporation**, Providence, has been incorporated under the laws of Rhode Island for the manufacturing and dealing in merchandise, clocks, jewelry, etc. with an authorized capital of $50,100 divided as follows: 3,340 shares of common stock at $10 each and 1,670 shares of common B stock also at $10 each. The incorporators are: **Emanuel Driesiger** and Elizabeth **Cantor** of New York City and **Sophie Abramowitz** of Brooklyn, N. Y.

Gogay Inc. of Providence, has been incorporated under the laws of Rhode Island to conduct a manufacturing jewelry business in Providence with an authorized capital of $10,000 divided into 1,000 shares of common stock of $10 each. The incorporators are: **James P. Felch**, 852 River Avenue; **Ernest Steiner** and **John J. Doyle.**

Edward N. Cook, president-treasurer of the **Edward N. Cook Plating Company,** of this city, who has been going to Maine on hunting and fishing trips for the past forty-two years, has received a complimentary hunting and fishing license from Governor Louis M. Brann of the Pine Tree State. **Mr. Cook** returned early last month from his forty-second consecutive trip to the William Tell Club at Moosehead Lake.

William Whytock, former treasurer of **The Roland & Whytock Company,** has disposed of his interest in that concern and has formed a new corporation under the name of The **William Whytock Company,** to manufacture screw products and jewelry finds at 67 Friendship Street.—**W. H. M.**

Middle Atlantic States

Newark, N. J.

January 25, 1937.

The strike in the automotive industry effected the plant of the **Hyatt Roller Bearing Co.,** Harrison, where several hundred hands were laid off because of the stoppage of orders for the Western concerns. The help will be taken back later.

Norman Geiger, manufacturing electrical and radio parts at Kearny, has leased 42,000 square feet of a mill at East Newark and will give employment to 600.

Ross Manufacturing Corp., of East Orange, manufacturers of welding and annealing apparatus, has filed an involuntary petition in bankruptcy. The company has admitted insolvency.

The **American Brass Co.,** of Waterbury, Conn., has leased space in the National Newark Building. LeRoy B. Smith will be in charge of the office.

Following Newark concerns have been incorporated: **Artistic Wire Products Co.,** 1,500 shares preferred, 1,000 shares common, no par; **Dura Electric Lamp Co.,** $125,000; **Atlas Lamp Corp.,** $125,000; **Perfection Products, Inc.,** metal products, 100 shares, no par.

—C. A. L.

Trenton, N. J.

January 25, 1937.

The State Department of Labor reports that there have been many new industrial projects erected in New Jersey during the past few months, adding many new employees. The Trenton plants report an increase in business with good prospects for early Spring trade.

The **Diamond Silver Co.,** Lambertville, N. J., has purchased a plant at that place for departments of the flatware factory. The Diamond Co., manufacturers of silver tableware, is expanding its plant because of the increase in business. The company has enough orders on hand to keep operations at normal for several months. New machinery is being installed.

Following concerns have been chartered at Trenton: **James R. Marsh, Inc.,** Essex Falls, metal products, $10,000 preferred, 500 shares common, no par; **Cal-Chem, Inc.,** manufacture chemicals, Asbury Park, 1,000 shares, no par; **F. J. Rooney Lamp Co., of New Jersey,** Hoboken, N. J., $10,000.

—C. A. L.

Middle West

Detroit, Mich.

January 25, 1937.

The only cloud hanging over industrial conditions in this area is the motor car strike that is handicapping and slowing up, not only the actual manufacture of new cars, but also accessory plants wherein brass, copper, aluminum and gray iron are concerned.

When the assembly lines stop, as they have in one of the largest plants in the United States, accessories begin to back up and that means production slow-ups and shut-downs for a wide range of industries. A strange feature of this strike is that it is being maintained by a minority of motor car workers who demand that they be the spokesmen for everyone employed in the industry. Their success remains to be seen.

According to **Robert Pierce,** treasurer of the Briggs Manufacturing Co. here plans have been completed for the merger of the **Briggs** and the **Motor Products Corpn.,** also of Detroit. Briggs is a large independent motor body manufacturer. Motor Products makes a variety of metal parts used in motor car production. Total assets of the Briggs organization as of Dec. 31, 1935, were $42,468,414. Those of the Motor Products as of the same date were $7,740,998, it is stated.

Ralph Upson, designer, told more than 400 persons at a Society of Automotive Engineers meeting in Detroit on Monday, Dec. 14, that metal covering for planes had come to stay and in a few years no fabric-covered planes would be manufactured. **James Greig,** body experimental engineer, of the Hudson Motor Car Co. also reported that the weight of passenger cars would become steadily less within the few years. **William B. Stout,** airplane and car designer, told the group that there will be more progress made in the automotive field in the next five years than in the last ten.

The **Midwest Abrasive Co.,** according to its president, **James T. Jackson,** is making plans for a greater increased volume of business than was experienced during the previous year which was a top mark for the organization. This necessitates, he says, further plant expansion in order to keep step with the accelerated demand. In addition to Mr. Jackson, the president, other officers are **Morgan W. Burt** and **L. V. Dippell,** vice presidents.

Announcement is made that construction of a new factory and power unit is to be started early this month by the **Burroughs Adding Machine Co.,** on Plymouth Road, in a suburban area. Plans call for a five story building, 600 feet by 135 feet. Production in the new plant, it is stated, will consist of auxiliary products, thus permitting the expansion of the major lines in the Detroit factory on Second Boulevard. It is reported that the expenditure will involve upwards of $5,000,000.

—F. J. H.

Election of **Zaven Lucassian** to succeed the late **Hrant Kirazian,** president of the **Hackett Brass Foundry** for the past 25 years, has been announced. Other officers are **Virginia Kirazian,** vice president, and **Helen Lucassian,** secretary and treasurer.

Pacific States

Los Angeles, Calif.

January 25, 1937.

The strike on the Pacific Coast of the employees of the water borne traffic, has already caused losses to trade of over $100,000,000 and about the same on the eastern coast and half that on the Gulf. About 400 steamers are tied up, many factories are closing, losses to labor of $10,000,000 in wages. If it is not settled soon hundreds of factories will have to close up. All foreign trade has been killed off; also the coast.

The **Bridgeport (Conn.) Brass Co.** are having built a warehouse here at 130 South Hewitt St.

The **Wire & Metal Mfg. Co.** of Glendale and Los Angeles, are making a new folding metal display rack.

The **Repcal Brass Co.** are making new shower bath fixtures, which eliminates the hot scalding water.

The **Williams Radiator Co.** are making a new line of automatic heat control devices, to automatically turn on and off at 70 degrees.

The **West Coast Sanitary Manufacturers** are making a new idea in fixtures, to hang the bath tub on the wall, instead of putting it on the floor.

C. C. Colyer of 4930 Gramercy Pl. is making hammered silver products.

The **Lionel Service Station** at 761 East 9th St., are making metal toy trains.

Jessie S. Smith of 553½ South Coronado St. and Mrs. B. M. Stevenson of 725½ West 43d St., have gone into making art jewelry; also **Philip Faval** of 6731 Hollywood Blvd.

—H. S.

Metal Market Review

January 28, 1937.

Copper saw the old year out in fine style with its third rise within the month, from 10.50c to 12c per pound electrolytic. On January 11th, the price was advanced to 12.50 and on January 14, to 13c. During the balance of the month the market was unchanged. This excited climb was caused, of course, as in the past, by the continued rising of the price in London which kept it above the American figure. The London market at the time of writing is much quieter, speculators having subsided for the time being.

The American sales for the month to January 28th, totalled 50,497 tons. Total stocks of refined copper in the hands of producers reporting to the Copper Institute, foreign and domestic amounted to 353,150 tons at the end of December, an increase of 114 tons over the previous month. Foreign holding increased 10,361 tons and domestic supplies decreased 10,247 tons. Domestic apparent consumption for December totalled 82,209 tons a record for the year.

Senator Brown of Michigan has proposed that the tax for 4c on copper be extended for two years.

Zinc which closed December at 5.45, Prime Western, E. St. Louis, was advanced to 6c January 13 and maintained that price throughout the month. The reason for its rise was the favorable statistical showing for December, a reduction in stocks of 12,771 tons from November. Total on hand amounted to 44,756 tons against 57,527 tons a month before, and 83,758 tons a year before. Shipments for December totalled a new high 59,821 tons.

Sales week by week were 3,000 tons, 17,000 tons, 7,400 tons, 2,000 tons making a total of 29,400 tons. Sellers regard the market as firm on its present basis.

Tin ended December at about 51.65c per lb. Straits. On January 5th the International Tin Committee agreed to continue the tin control until the end of 1941, which was probably the cause of the rise during the previous week or two. The price reacted moderately to a round 51 with a quiet market due probably to an increase in surplus stocks. During the last week of January the flood and the threatening labor situation in the American automobile industry depressed the metal still further to 50.10 on January 27th. The market is dull at this time.

Lead, which had also had an exciting time during December, rounding out the month at 5.85c per lb. E. St. Louis, started the new year buying on a somewhat reduced scale. Sales increased rapidly, however, and consumers became concerned about a possible price rise. Statistics showed that stocks of refined lead in the United States were reduced 4,537 tons during December bringing the total down to 172,423 tons compared with 222,306 at the beginning of 1936. The price was unchanged, however, remaining at 5.85 up to January 27, the time of writing.

Sales week by week were 3,600 tons, 7,900 tons, 7,000 tons, 2,300 tons, a total of 28,000 tons. Market firm.

Silver moved in a very narrow range throughout January. Beginning the month at 45c per oz. Troy it went as high as 45.50 the following week then back to 44.75 where it remained. Trading in London and on the Indian bazaars was quiet and no marked developments of any importance occurred.

Handy and Harman the international bullion house, issued its Annual Review for 1936 concluding in the summary that the Silver Purchase Act has outgrown its original objective and that the law should be repealed, taking precautionary steps to prevent any serious dislocation of the markets. World production in silver was 253,000,000 ozs., 218,500,000 in 1935. It is estimated that the U. S. Government holds 1,900,700,000 ozs. and based on the present gold stocks of about $11,258,000,000, the silver holdings are still about 1,000,000,000 ozs. short of the required amount under the Silver Purchasing Act.

Platinum stood pat at $48 per oz. until January 25th when it was advanced to $58, the first revision in price since October 26th. The reason for this advance was revival demand abroad. Buying in the U. S. is still moderate.

Scrap Metals rode upward with the rise in primary. Domestic scrap copper bids climbed close to export levels as scrap offerings fell off due to the diversion of the material for export at higher prices. Some teetering up and down occurred during the third week but bids were again raised.

Secondary aluminum was largely firm and steady but became lively toward the last.

The combined delivery of brass and bronze ingots and billets by members of the Non-Ferrous Metal Institute for the month of December amounted to a total of 7,939 tons.

On January 1st the unfilled orders for brass and bronze ingots and billets on the books of the members amounted to 33,077 net tons compared with 18,739 tons at the beginning of the year. Total deliveries for the year were 78,483 tons, a monthly average of 6,540 tons.

The wrought metal industry, although subjected naturally to a seasonal slowing down continued to operate at a high rate and to take deliveries of metal steadily. Employment in the Connecticut Valley section almost reached its old time 1929 levels. The automobile strike, however, has had a tendency to slow down operations as cancellations are beginning to come in. This is also affecting the Middle Western mills.

A large metropolitan distributor estimates January business at about 10% over December and about 10% over January 1936.

Non-Ferrous Ingot Metal Institute reports the average prices per pound received by its membership on Commercial Grades of six principal mixtures of Ingot Brass during the twenty-eight day period ending January 22.

80-10-10 (1½% Imp.)	14.395c
78% Metal	11.715c
81% Metal	12.258c
83% Metal	12.805c
85% Metal	12.580c
No. 1 Yellow Brass	10.002c

AVERAGE PRICES FOR METALS

	JANUARY
Copper c/lb. Duty 4c/lb.	
Lake (del. Conn. Producers' Prices)	12.722
Electrolytic (del. Conn. Producers' Prices)	12.660
Casting (f.o.b. ref.)	12.306
Zinc (f.o.b. E. St. Louis) c/lb. Duty 1¾ c/lb.	
Prime Western (for Brass Special add 0.05-0.10)	5.86
Tin (f.o.b N. Y.) c/lb. Duty Free, Straits	50.890
Lead (f.o.b. St. L.) c/lb. Duty 2⅛ c/lb.	6.000
Aluminum c/lb. Duty 4 c/lb.	20.500
Nickel c/lb. Duty 3 c/lb. Electrolytic 99.9%	35.000
Antimony (Ch. 99%) c/lb. Duty 2c/lb.	14.137
Silver c/oz. Troy, Duty Free	44.912
Platinum $/oz. Troy, Duty Free.	49.675
Gold—Official U. S. Treasury Price $/oz. Troy	35.000

Metal Prices, January 28, 1937

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

NEW METALS

Copper: Lake, 13.125, Electrolytic, 13.00, Casting, 12.70.
Zinc: Prime Western, 6.00. Brass Special, 6.10.
Tin: Straits 50.20.
Lead: 5.85. **Aluminum,** 19-22. **Antimony,** 14.25.
Nickel: Shot, 36. Elec., 35.

Quicksilver: Flasks, 75 lbs., $95. **Bismuth,** $1.00.
Cadmium, 75c to $1.05. **Silver,** Troy oz., official price, N. Y., Jan. 29, 44.75c. **Gold:** Oz. Troy, Official U. S. Treasury price, $35.00. **Scrap Gold,** 6¾c. per pennyweight per karat, dealers' quotation. **Platinum,** oz. Troy $58.00.

Duties: Copper, 4c lb.; zinc, 1¼c. lb.; tin, free, lead, 2½c. lb.; aluminum, 4c lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

INGOT METALS AND ALLOYS

	Cents lb.	U. S. Import Duty	U. S. Import Tax*
No. 1 Yellow Brass	11.00	None	4c.lb.[1]
85-5-5-5	14.00	None	4c. lb.[1]
88-10-2	18.00	None	4c. lb.[1]
80-10-10	16.125	None	4c. lb.[1]
Manganese Bronze (60,000 t. s. min.)	13.00	None	4c. lb.[1]
Aluminum Bronze	18.00	None	4c. lb.[1]
Monel Metal Shot or Block	28	25% a. v.	None
Nickel Silver (12% Ni)	15.00	20% a. v.	4c. lb.[1]
Nickel Silver (15% Ni)	17.50	20% a. v.	4c. lb.[1]
No. 12 Aluminum	19-25	4c. lb.	None
Manganese Copper, Grade A (30%)	22-28	25% a. v.	3c. lb.[1]
Phosphor Copper, 10%	16-18	3c. lb.	4c. lb.[1]
Phosphor Copper, 15%	17-19	3c. lb.	4c. lb.[1]
Silicon Copper, 10%	21-33	45% a. v.	4c. lb.[1]
Phosphor Tin, no guarantee	57-75	None	None
Iridium Platinum, 5% (Nominal)	$62.00	None	None
Iridium Platinum, 10% (Nominal)	$66.00	None	None

* Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.
[1] On copper content. [2] On total weight. "a. v." means ad valorem.

OLD METALS

Dealers' buying prices, wholesale quantities:	Cents lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	10⅜ to 10⅝	Free	4c. per pound on copper content
Light copper	9⅜ to 9⅝	Free	
Heavy yellow brass	6½ to 6¾	Free	
Light brass	6⅛ to 6¼	Free	
No. 1 composition	9¼ to 9⅜	Free	
Composition turnings	9 to 9⅛	Free	
Heavy soft lead	5½ to 5⅝	2⅛c.lb.	None
Old zinc	3 to 3¼	1½c.lb.	
New zinc clips	4 to 4¼	1½c.lb.	
Aluminum clips (new, soft)	14 to 14¼	4c.lb.	
Scrap aluminum, cast	12¼ to 12½	4c.lb.	
Aluminum borings—turnings	6¾ to 7	4c.lb.	
No. 1 pewter	36 to 37	Free	
Electrotype	5¼ to 5½	2⅛c.lb.*	
Nickel anodes	28 to 29	10%	
Nickel clips, new	30 to 31	10%	
Monel scrap	8½ to 15	10% av.	

* On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' price lists, effective since January 14, 1937. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

COPPER MATERIAL

	Net base per lb.	Duty*
Sheet, hot rolled	20⅜c.	2½c. lb.
Bare wire, soft, less than carloads	17⅛c.	25% a. v.
Seamless tubing	21⅜c.	7c. lb.

* Each of the above subject to import tax of 4c. lb. in addition to duty, under Revenue Act of 1932.

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	27⅞c.	10% Quality	30½c.
15% Quality	30 c.	15% Quality	34⅞c.
18% Quality	31¼c.	18% Quality	38⅛c.

BRASS AND BRONZE MATERIAL

	Yellow Brass	Red Brass 80%	Comm'l. Bronze	Duty	U. S. Import Tax
Sheet	18⅛c.	19⅛c.	20¼	4c. lb.	4c. lb. on copper content.
Wire	18⅜c.	19⅜c.	20½	20%	
Rod	16⅛c.	19⅜c.	20⅜	4c. lb.	
Angles, channels.	26⅜c.	27⅝c.	28½	12c. lb.	
Seamless tubing.	20⅞c.	21⅝c.	22¾	8c. lb.	
Open seam tubing	26⅜c.	27⅝c.	28½	20% a. v.	

TOBIN BRONZE AND MUNTZ METAL

(Duty 4c. lb.; import tax 4c. lb. on copper content.)

Net base prices per pound.	
Tobin Bronze Rod	20 c.
Muntz or Yellow Rectangular and other sheathing	21⅜c.
Muntz or Yellow Metal Rod	17½c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.80
Aluminum coils, 24 ga., base price, ton lots, per lb.	30.50

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	49c.	Cold Rolled Sheet	53c.
Hot Rolled Rods	44c.	Standard Sheet	48c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	34	Standard Sheets (base)	38
Cold Drawn Rods (base)	39	Cold Rolled Sheets (base)	43

SILVER SHEET

Rolled sterling silver (Jan. 29) 46¾c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	10.50	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' prices)	11.25	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' prices)	15.25	2c. lb.
Full Lead Sheet (base price)	9.25	2⅛c. lb.
Cut Lead Sheet (base price)	9.50	2⅛c. lb.

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 46.

Supply Prices, January 29, 1937

ANODES

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 500 lbs. or more, and subject to changes due to fluctuating metal markets.

Copper: Cast ..... 22¾c. per lb.
Electrolytic, full size, 16⅝c. cut to size 17⅜c. per lb.
Rolled oval, straight, 18⅝c.; curved 19⅝c. per lb.
Brass: Cast ..... 21½c. per lb.
Zinc: Cast ..... 10⅞c. per lb.

Nickel: 90-92% ..... .45 per lb.
95-97% ..... .46 per lb.
99%+cast, 47c.; rolled, depolarized, 48.
Silver: Rolled silver anodes .999 fine were quoted Jan. 29, from 46¾c. per Troy ounce upward, depending on quantity.

WHITE SPANISH FELT POLISHING WHEELS

Even Diameters	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1" to 2"	$2.35/lb.	$2.23/lb.	$2.12/lb.
10-12-14 & 16	2 to 3½	2.35	2.23	2.12
6-8 & 18	1 to 2	2.35	2.23	2.12
6-8 & 18	2 to 3½	2.35	2.23	2.12
Over 18	Under ½	3.80	3.61	3.42
Over 18	½ to 1	3.45	3.28	3.11
Over 18	Over 3½	2.80	2.66	2.52

Odd Diameters

Less than 50 lbs.—add 40c. per lb. to "Even Diameters" list. 50 lbs. or over—all one size and consistency and in one shipment —same as "Even Diameters."

Extras: 25c per lb. on wheels, 1 to 6 in. diam., over 3 in. thick. On grey Mexican wheels deduct 10c. per lb. from above prices.

COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

16" 20 ply 84/92 Unbleached	$78.28
14" 20 ply 84/92 Unbleached	59.99
12" 20 ply 84/92 Unbleached	45.08
16" 20 ply 80/92 Unbleached	69.99
14" 20 ply 80/92 Unbleached	53.69
12" 20 ply 80/92 Unbleached	40.40
16" 20 ply 64/68 Unbleached	60.51
14" 20 ply 64/68 Unbleached	46.48
12" 20 ply 64/68 Unbleached	35.04

⅜" Sewed Buffs, per lb., bleached or unbleached 50c. to $1.38

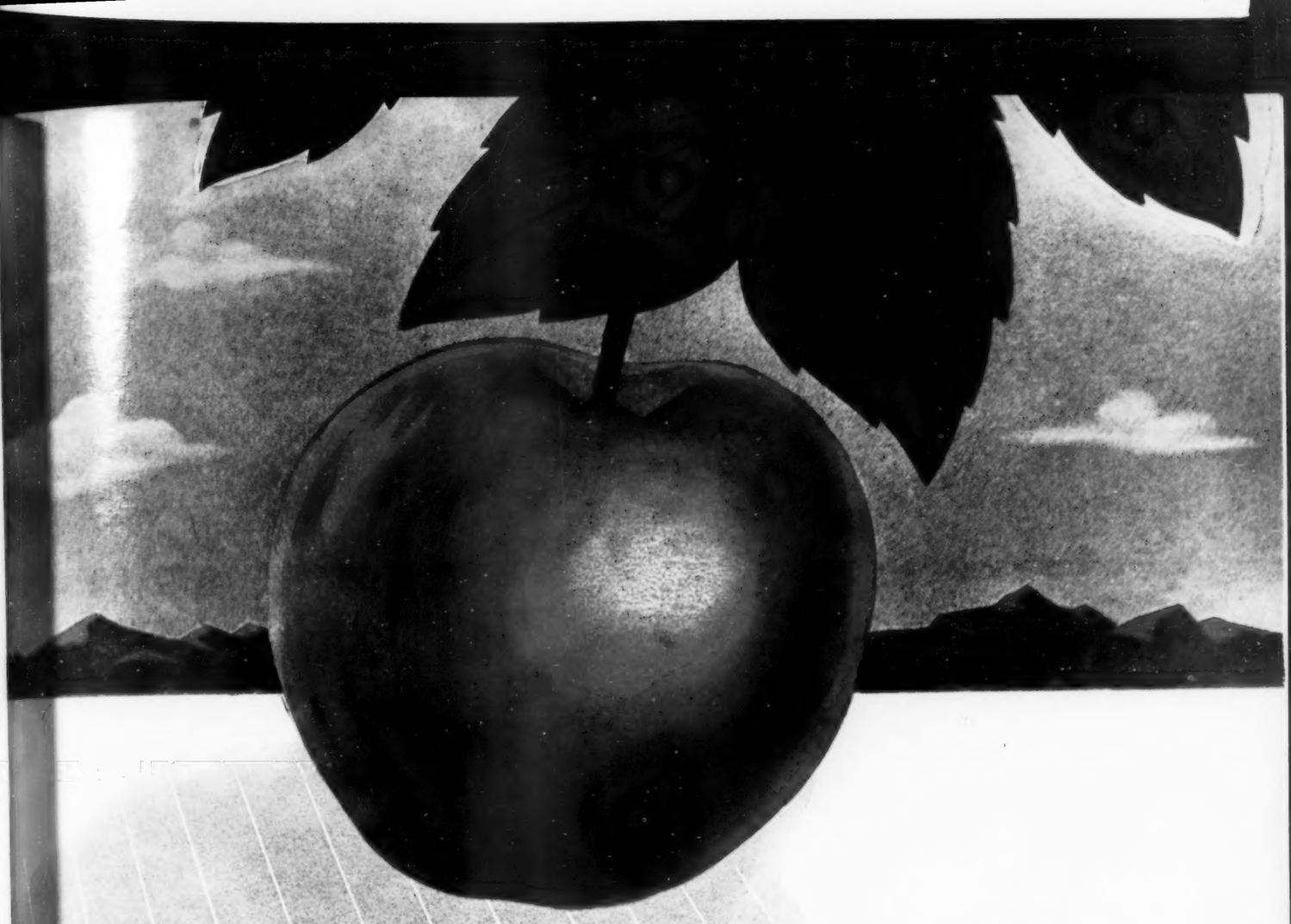
CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone C. P.	lb.	.07½
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.05¼-.05¾
Chromic, 400 or 100 lb. drums		.16¼-.16¾
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.03
Hydrochloric, C. P., 20 deg., carboys	lb.	.06½
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36 deg., carboys	lb.	.05-.06¼
Nitric, 42 deg., carboys	lb.	.07-.08
Sulphuric, 66 deg., carboys	lb.	.029
Alcohol—Butyl, drums	lb.	.09½-.10½
Denatured, drums	gal.	.30-.476
Alum—Lump, barrels	lb.	.03¼-.03½
Powdered, barrels	lb.	.0340-.0365
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02½-.05
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide, technical crystals, kegs	lb.	.55-.58
Arsenic, white kegs	lb.	.04½-.05
Asphaltum, powder, kegs	lb.	.23-.41
Benzol, pure, drums	gal.	.41
Borax, granular, 99½+%, ton lots	lb.	.0245-.0295
Cadmium oxide, 50 to 1,000 lbs.	lb.	1.05
Calcium Carbonate (Precipitated Chalk), U. S. P.	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05½-.06
Chrome, Green, commercial, bbls.	lb.	.20-.23
Chromic Sulphate, drums	lb.	.33-.55
Copper—Acetate (Verdigris)	lb.	.28
Carbonate, 53/55% cu., bbls.	lb.	.16¼-.17¼
Cyanide (100 lb. kgs.)	lb.	.38
Sulphate, tech., crystals, bbls.	lb.	.0485-.0555
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus Martis (Iron Oxide) red, tech., kegs	lb.	.07
Dextrin, yellow, kegs	lb.	.05-.08
Emery Flour (Turkish)	lb.	.07
Flint, powdered	ton	30.00
Fluorspar, bags	lb.	.03½
*Gold Chloride	oz.	$18¼-23
*Gold Cyanide, Potassium		$15.45
*Gold Cyanide, Sodium		$17.10
Gum—Sandarac, prime, bags	lb.	.50
Shellac, various grades and quantities	lb.	.21-.31
Iron Sulphate (Copperas), bbls.	lb.	.016

*Subject to fluctuations in metal prices.

Lead—Acetate (Sugar of Lead), bbls.	lb.	.11½-.14¼
Oxide (Litharge), bbls.	lb.	.12½
Lime Compositions for Nickel	lb.	.09½-.11
Lime Compositions for Brass	lb.	.09½-.11
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, (Wood Alcohol) Pure, drums	gal.	.40½
Nickel—Carbonate, dry, bbls.	lb.	.36-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.13½-.14½
Salts, double, 425 lb. bbls.	lb.	.13½-.14½
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.07¼-.08⅝
Potassium—Bichromate, casks (crystals)	lb.	.09
Carbonate, 98-100%	lb.	.06¾
Cyanide, 165 lbs. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.07½
*Silver—Chloride, dry, 100 oz. lots	oz.	.38
Cyanide, 100 oz. lots	oz.	.44
Nitrate, 100 ounce lots	oz.	.32¾
Soda Ash, 58%, bbls.	lb.	.0225
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17½-.22
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate, granular, bbls.	lb.	2.75-3.15
Nitrate, tech., bbls.	lb.	.0240
Phosphate, tribasic, tech., bbls.	lb.	.03
Silicate (Water Glass), bbls.	lb.	.01½
*Stannate, drums	lb.	.33-.36
Sulphocyanide, drums	lb.	.30-.45
Sulphur (Brimstone), bbls.	lb	.02¾
*Tin Chloride, 100 lb. kegs	lb.	.38
Tripoli, powdered	lb.	.03
Trisodium Phosphate—see Sodium Phosphate.		
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
White Silica Compositions for Brass	lb.	.07½-.10
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.12-.13
Cyanide (100 lb. kegs)	lb.	.36-.38
Chloride, drums, bbls.	lb.	.06
Sulphate, bbls.	lb.	.0355



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